# SCIENCE

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## THE FORTHCOMING SITUATION IN AGRICULTURAL WORK—II[1]

ONE year ago, at the first meeting of Section M, it was my privilege to speak on some of the tendencies in the great public agricultural movements in the United States, particularly on the educational side, and to express my conviction that the processes set in motion by the Land-Grant Act and subsequent enactments are safeguarding the foundations of our democracy. I approached my subject mostly from the point of view of our present public-service or public-welfare institutions for agriculture; I said that I should discuss the other or non-public phases of the problem one year hence. And now, after twelve months of unrepentance, I come to resume my theme. In continuing the discussion I shall be obliged to reaffirm some of the positions that I urged a year ago.

It is now some seven years ago when I wrote in a book that there may be need of a kind of agricultural work that can best be done in an institution independent of direct state support and not at once responsible to popular will.[2] That statement, or its equivalent, had been made many times theretofore in public ways. I have never taken the privilege, however, to enlarge upon it to any degree: this opportunity is reserved for to-day.

Fortunate it is for us that our educational and to a large extent our civic and welfare work for agriculture have been founded on public funds, thereby committing the state to the necessity of furthering the interests of our basic industry and of

[1] Retiring vice-presidential address, Section M.
[2] "The Training of Farmers," page 225.

making it an active factor in the political establishment. Had all this chain of colleges of agriculture and experiment stations and the great range of extension work and the giving of expert advice been established on private gifts, they would have been philanthropies or at least concessions to a needy industry. The state has recognized the necessity to base itself on the earth, and the enterprise is generously supported.

This, then, is my starting point—that these state-maintained institutions which aim to safeguard and to develop the resources of the earth are essential to permanency in society and also to self-government. Having accepted this basis, we may now ask whether there is need for another set or kind of institutions dealing with the rural situation, or whether such a set would benefit or hinder the public establishments that are now so well developed.

Let me say at once that the field of such institutions, whether public, semi-public or private, is now well understood. The prophetic writings in this nature-field and this agriculture-field are of our own time and of the time just preceding us. The philosophy of the situation, in its great human bearings and in its governmental and social results, has been clearly projected. The fundamental statements have been made. The main forecasts are mostly recent. We are emerging from the generation of search for the underlying elements and of the prophecy for future action. We enter the generation of hopeful and constructive application. At last we begin to see the actual reshaping of country life.

### THE PROBLEM OF OVER-ADMINISTRATION

As our philosophy begins now to shape itself into definite action, so do our colleges and experiment stations begin to take on an institutional character. With the passage of the Extension Act, the institutions become real parts in a national system. Administration is now the dominant note in them, whereas formerly the work and attainments of individual men gave them their distinction. In the nature of the case, the administrative forces will increase: the elements must be organized; it is easier and simpler to make plans of administration than to do good research work or superlative teaching. Persons of little training in productive work are now engaged in making plans of administration, a situation that is always dangerous.

It is of the first importance, both to the work itself and to the political democracy we represent, that we do not think of agricultural education and research primarily in terms of organization. In this country where we are all sovereigns and all politicians, it is the easiest thing to slip into political methods, not to say political practises, in education. We must be on our guard against the spiritless domination that is likely to arise in educational and investigational endeavor when it becomes formal, and be aware of those tendencies that confuse red-tape and obstructive duties with administration. An enterprise is not commendable merely because it is "regular" and smooth-running. It is a sad case if personality is ever subordinated to regularity. A man is always more important than a rule.

The tendency toward outside centralized administrative control is well seen in movements now under way in this country to eliminate duplication and conflict between public institutions in a given state by means of one board of control placed over all of them, or by one chancellorship administering all of them from a common office. If it is desirable to conserve the free action and the spirit of a teacher or an officer, as a

means of maintaining the essential forces in a free people without peasantry, so is it necessary also to safeguard the independence of the institution that holds the teachers. Every institution is entitled to its own life.

It would be a vast misfortune if all our state educational institutions were made to be uniform in procedure, even when they are of the same grade or rank. Diversity is the order of nature. We are now run wild in this country in the application of so-called efficiency systems to institutions and agencies that in the nature of their purpose ought to be of the spirit rather than of the letter. Often these systems do not really represent efficiency, but the effort of officers and clerks without either vision or discretion, and perhaps supercilious, to make all things uniform; and more time and money may be lost in this effort than is saved in the purchase of supplies or in the stoppage of the leaks. It is a serious case to deprive the responsible officer of an institution of the right to exercise his discretion.

It is a gross mistake to suppose that management systems usually applicable to a factory can be applied to a college or a university, or to an experiment station or a research laboratory, and for the very good reason that the products are wholly unlike, —manufactured goods in the one case, human souls and scientific truth in the other. So also are the methods of procedure unlike—time-work and a measurable output in the one case, study, reflection, mental recuperation, inspiration, soul-service in the other. The institutions must be allowed to become what they are intended to be.

We are face to face with a struggle to keep educational institutions free not so much from political control as from the deadening domination of fiscal offices. A well-known professor in a college of agriculture writes me that his institution has now become so efficient that he loses one third of his time from all productive work; and another declares that frequently he spends an entire day in making reports that have no significance except to maintain a scheme of administration and which could be performed just as well by a ten-dollar clerk. All this means that we are in immediate danger of developing in our institutions a set of administrative officers, controlling affairs, who are separate in spirit from the real work of research and education. To this tendency add the present peril of similar despotism from state officers, and you have a slowly developing method of strangulation that may well cause alarm.

If you ask me how we are to avoid these duplications and conflicts between state institutions, then I reply that the remedy lies in the constitution of the institutions themselves and not in the method of governance. You can not bring together, by any means of overhead regulation, institutions that in themselves are inharmonious. You may allay the hostilities, by arbitrary regulation you may prevent duplication, but this is not a solution, but only an adjustment; and the arbitrary regulation of finances and accounts will inevitably in the end control the educational policies of the institutions, and will ultimately deprive them of independent free-spirited presidents and leaders. The danger lies in the future rather than in the present. The real remedy for such situations rests with the constitution or the legislature (or with bodies to which it delegates legislative authority) to define the purposes and the spheres of the institutions; with their charts before them, the institutions then undertake each its own voyage.

There is still another aspect to this unfortunate hostility between state institutions. It is the championship of the insti-

tution by alumni, in their organizations and elsewhere, and which may practically enforce the necessity of exterior regulation. The alumni loyalty is a fine spirit, much to be desired; but the first loyalty in the case of public-maintained institutions is to the state rather than to the college. The alumni attitude of the older eastern endowed colleges has been transferred bodily to state colleges, without discrimination and without realization of the fact that state relationships are involved. Herein lies one danger of alumni trustees in state institutions, although the alumni ought to make the best of advisers.

If we could get hold of the alumni bodies on the basis of good state policies rather than on the basis of blind partisanship, we should soon be able to solve most of our institutional conflicts, at the same time that we retain the needful support of the alumni of each one of them. We should then be free to make our institutions parts in a well-understood state program, and to allow each institution to work out most of its own problems. Undoubtedly some small duplications or perhaps even infringements would remain, but they would be devoid of hostility and have little power for evil, whereas the gains to come from free action would far outweigh any lack of conformity to an office or paper plan. It ought not to be difficult to make adjustments by means of conference if the underlying situation is properly established.

How to bring these alumni bodies to their senses is indeed a difficult problem. As these persons have been educated at state expense, so does the state have a right to ask service in return; and, if necessary, I should go so far as to give the alumni organizations legal standing and more or less state control. I feel, however, that the better result can be secured by processes of suasion. If a governor of a state, or the presidents of the institutions, or a few leading spirits in the alumni associations were to make an appeal along these lines, the whole situation would probably right itself in the course of a few years. It is more important first to appeal to the alumni than to the legislature. We are in too great haste to eliminate these difficulties. We must remember that these situations are the results of long-continued conditions; the difficulties are chronic and ingrained; so will it require time to work them out. We are to undo the mischief by gradually reversing or at least revising the process, not by a broadside of regulatory legislation.

All these foregoing statements indicate the drift of the time in the direction of over-administration, coupled with more or less hasty legislative enactments to meet special troubles. The remedy does not lie wholly, and perhaps not even chiefly, within the establishments themselves; in fact, routine tends to multiply, and to extol itself as desirable on its own account. Reformation is peculiarly the work of outsiders.

The course of our legislation in the field of education in agriculture shows a gradual federalizing of it, beginning with practically entire freedom in the original Land-Grant Act. In the new Smith-Lever Act the remedy—if a remedy is needed—does not lie within itself. Cooperation is not a remedy: it is an adjustment, a method of procedure, and it works only when all the parties agree. If the Land-Grant Act had been written and applied on the same principle, we could not have had our existing colleges of agriculture.

### Another Kind of Agricultural Work

Well, then, where is the external influence to be maintained? Where is it to arise? Primarily in the suggestions of a free people. But its continuous practise must come from institutions.

> There may be need, also, of a kind of agricultural work that can best be done in an institution that is independent of direct state support, and that is not at once responsible to popular will.

The fuller statement, from which this sentence is a quotation, is this:

> The teaching of agriculture of college and university grade ought not to be confined to colleges of agriculture. All universities at least, on their own account and for their own best development, will in time have departments of agriculture, if they are real universities, as much as they have departments of language or of engineering. They can not neglect any fundamental branches of learning.[3]

At an earlier date, I had written:

> It is strange that private benevolence has not discovered that the founding of schools of agriculture is one of the very best means of serving mankind.[4]

As these statements seem not always to have meant the same to others as I thought they meant to me, I shall now enlarge on them; and thereby shall I both explain myself and make my application.

My primary contention at the moment is that the agricultural and rural subjects may be made a means of education, used as so-called culture studies, and that a knowledge of them on the part of a large proportion of the people, in their general bearings, is essential to training for citizenship. They therefore become by right a part of the content of a school and of a college course. If any institution essays to cover the field of higher education, and is free to do so under the terms of its charter or of its state relations, then agriculture can not be omitted. Of course no institution should admit agriculture into its curriculum until it is ready for the subject and can provide the necessary support, any more than it should admit Greek or economics until it is ready for the subject. To be ready for agriculture requires much more than equipment and adequate funds: the institution, in its governing body and in its faculty, should come to the subject on the same educational basis as it comes to any other subject, prepared to give it opportunity and sympathetic consideration, and to make it in fact a worthy coordinate with other departments.

The agricultural work of which I here speak is to be a contribution to other courses and departments in a university. It might very well be a department in an arts course. Unfortunately, we think of agriculture in higher institutions of learning only as a very highly developed series of technical courses, maintained mostly on a semi-professional basis. This is properly the development in the land-grant colleges of agriculture; and in them, although the differentiation has gone very far, it will go still farther, for we must bring our rural situation up to its proper level. But in general and liberal-arts endowed universities, agriculture of another species may well be introduced, comparable with a department of a college rather than with a college entity itself. It need not provide "a course in agriculture," in the sense of a complete curriculum by itself, and it would not give a degree in agriculture. We can not expect all students desiring agriculture as part of a liberal education to matriculate in a college of agriculture.

The content of such teaching of agriculture would probably run strongly along the lines of the so-called humanities—along economics without being the customary economics, along civics without being the usual civics, along ethics without being speculative ethics, and always be founded on good sources of technical information touching the nature and processes of production, the values in rural life, knowledge of agricultural conditions, with frequent visits in rural communities and excursions

[3] "The Training of Farmers," p. 225, 1909.
[4] "The State and the Farmer," p. 166, 1908.

for special studies. Such an organization for agriculture would not need the extensive equipment of a college of agriculture, and not even a farm.

It will be observed that I speak of agriculture for endowed universities and colleges that are supposed to cover the field of liberal education. Whether agriculture of any kind should be taught in a state university in a commonwealth in which the land-grant college is separate, is a question of state policy. By the act of separating the institutions, the state practically sets boundaries to the university as well as to the land-grant college; it always remains, then, as I have already intimated, for the state itself, clearly to define the purposes and the functions. It is likewise a question of policy, internal in this case, as to whether even in a university carrying the land-grant work there should also be an arts course in agriculture.

I am convinced that we greatly need such departments of agriculture as are here suggested. The institutions need it on their own account, and we need it for the cause of education and to train our people for self-government. There is no such professorship of agriculture as this, so far as I know, in this country. The institutions are missing an opportunity.

My impression is that a first-class department of agriculture in a first-class university, with a living man at the head of it who has had naked-hand experience on the farm, would exercise a kind of influence in the subject and on the country that is now unvisioned, although much needed. I suspect that the judgment of such a department would have unusual weight with the public, being perhaps non-professional and free of propaganda and of governmental policies. I foresee students going from such teaching to the colleges of agriculture for more detailed and technical work; and I think I foresee certain students going to such a department for reflective graduate study and for the privilege of acquaintance with a teacher who is not buried in organization.

The old-time college professor, giving himself personally to his students, with few assistants, provided a type of leadership and of influence of the highest value; he lived the life; he was content in his work. To this man add something of the activity of the working world, but without administration of great schemes and without a maze of paralyzing reports, returns and projects, and you have your perfect teacher.

This teacher would be in position to maintain poise. He need not be afraid of deliberation. He would be greatly satisfied to watch the procession go by. We need a certain number of these men who are not only good students, but who are so detached from plans and managements that they can keep our philosophy straight.

### THE CHECK PLOTS

We very well know that we need outside enterprises and influences to correct the tendencies of government. Education and research in agriculture are tied up with governmental procedure.

I would not have you think that I am opposed to governmental supervision. I do not even raise the question of the advisability or the merits of enactments or policies, although ready to review the tendencies in certain practises; and I wish distinctly to give my voice for the meeting of the laws to their full and in a whole-hearted way. Regard for law and authority is as much a safeguard of a free people as is the necessity for individual action. I am not implying that things are going bad with us, or that any of the agricultural enterprise is suffering. On the contrary, I think that our governmental work in agriculture

is on the whole particularly good. I know many of the men in this line of governmental oversight, and how capable they are. I know that we must have regularized procedure and good organization. It is said that for the greater number of persons close supervision is necessary, to which we all agree; and yet it is surprising how quickly these persons respond to leadership.

I know, on the other hand, that it is possible for governments, or methods suggested by governmental necessities, to invade educational work where they are not needed. I fear that the days of much freedom and spontaneity in the work are more behind us than ahead of us. We naturally extend a method or a way of procedure throughout a system, as if uniformity were in itself an asset. The very expansiveness of the enterprises, the extent of funds involved, the vast size of the country, the numbers of students, the alertness of the people for solutions, all demand a complex method of administration and tend to immerse a man in the system. I do not see how it can be avoided. All the more is the necessity, therefore, for opportunities to those persons who wish to do a personal work and to express themselves—just themselves—in the doing it. All the more do we need the example of institutions which have policies wholly their own, to safeguard any future danger of too much regulation in the governmental side. One set would prove a powerful stimulus to the other as well as to exercise a natural control. I hope there will never be any need of outside suggestion to restrain persons in the public institutions who aspire to be governors, congressmen, and the like, who may be tempted to use their opportunities to that end, and who are thereby out of place in college and science work.

As the public work becomes more crystallized and more official, as is of course inevitable, the colleges of agriculture will begin to lose their boldest men. We know that many men in government like to escape to institutions, as to universities: will they desire also, in time, to escape the institutions?

You must not think that I am here summoning the bogy-man of "politics," as a discouragement to institutions supported by the state. Quite the contrary: I have seen something of institutions; I fear the entrance of "politics" as much into the governance of other institutions as of state institutions, and perhaps even more so, seeing that it is not answerable to public correction. We are moving rather rapidly in these days away from star-chamber deals and partizan control and upheavals. But there remains the more dangerous because the more insidious formalizing of the daily work, regulating of hours, deadly conforming of editorial offices, employing of too many clerks and intermediaries, the gradual tying of the hands without any intention whatever that it shall be so, the piling up of paper duties. That is to say, the old-time fear of politics has now been superseded by the actual danger of impersonal interference in details and of machine routine. I am not so much afraid of "politics" as I am of the dead-levels.

The old separatism in agriculture is breaking up. The human forces are reshaping. New crystallizations are taking place before our eyes, rapidly. Many plans of cooperation and co-action, small and large, are much recommended. Now is the time to be careful that our rural life shall not be machine-made and over-organized.

### THE FIELD FOR PRIVATE FOUNDATIONS

The land-grant colleges of agriculture are not to expect to hold exclusively the entire field of agriculture-education of the

higher grade, nor is it desirable that they should do so. They do not necessarily represent the last word in this field of public service. We must soon begin to think of another range.

Private philanthropy will find this inviting and useful field. Universities of many kinds will enter it as of their own domain. The land-grant institutions will not lose their influence and standing: on the contrary, they ought to begin to produce the leaders for the other development, and specially must they be prepared to accept the other institutions, when those institutions are really ready and worthy, and give them encouragement; and in particular must they not sit as censors.

These new developments being foreseen and I think inevitable, then a *modus vivendi* must be found in advance. The first desirability, as I have suggested, is an attitude of encouragement for all good effort in teaching and research; the next essential is a willingness on the part of the land-grant institutions to divide the field, or at least to share it, so far as they can do so and not surrender their legal or necessary rights or curtail their usefulness. No one would want these institutions restricted; in fact, this must not be, since they have been set aside to do a great work in a democracy.

The other institutions, those not teaching agriculture on the land-grant basis, should recognize that the public-maintained colleges are now established in their field, that this field belongs to them by law, that these colleges are doing their work nobly, and that the people will resent interference; and they must remember the fine disdain in which the colleges of agriculture have been held in times past. These other institutions should not attempt to duplicate the work and equipment of the land-grant colleges; they should enter fields of their own. The effort to secure state support for such institutions is a perversion; it introduces the very element of competition and conflict that it is so necessary to avoid, and the institutions also thereby lose their special opportunity. Neither will these institutions, if they are wise, enter the field to secure advertisement for any university or any body, counting on the rising interest in agriculture; the land-grant colleges are fortunately too strong for such a purpose to gain much headway.

What these fields are, for the non-land-grant endowed institutions, may not be easy to forecast in detail; but if the institutions desire to find such a field, the danger of duplication, conflict and hostility will thereby be avoided. In fact, these other institutions can never acquire the place they ought to find and which they have a right to enter, by any movement of attack or of imitation. The example of the untrammeled spirit, which they ought to contribute to governmental enterprises, must of course be born in freedom and in great good will.

Already have we discussed the opportunity in a liberal-arts college or in a university for a department of agriculture. We may now consider what an endowed institution, established separately in the agricultural field, including horticulture, forestry, and other rural work, may undertake. There is opportunity and need in abundance in the training-school field, but we are not now considering this range. In the college and university range, it is probably not worth the while to undertake a new effort "to make farmers," although this particular fallacy seems to be very attractive to many men.

1. If the hypothetical institution is to engage in research, it had better not attempt to cover the field of agriculture, as the colleges of agriculture are obliged to cover it in order to answer the needs of the commonwealth; it had better confine itself to a problem or a set of closely related

problems, organizing carefully for the effort, equipping to the highest, securing the best investigators regardless of the salary cost and allowing them to give themselves unreservedly to the research, without extension work or propaganda. This kind of intensive investigation, long-continued, patiently pursued, not depending for support on popular will, not interfered with by endless extraneous records and reports of progress, not obliged to demonstrate the necessity for its existence, would have a far-reaching influence for good.

2. If the institution is designed only to enter extension work in agriculture, it had better cease before it begins. The public forces are already at the command of the national cooperative extension enterprises; these enterprises are founded on good investigational work and on the accumulation of experience in the regularly established institutions. Extension work should never be projected *in vacuo*.

3. If it is in teaching of the higher grade that the new separate institution would express itself, then it must find its place, if at all, by sheer commanding excellence. It will compete first of all with the land-grant college of its own state, if it is of comparable grade, and with similar institutions in forty-seven other states, not to mention those in the provinces of Canada; this will present at once a difficult situation. If it is of inferior grade, then it must recognize its place and not attempt to give a degree in agriculture, or otherwise to bring the educational standards in this new field, now being attained with much hard effort, into disrepute. I can imagine a very worthy private foundation on college and even on university grade, making its way continuously and successfully, but I should expect it to make best headway if it specialized rather than attempted to cover the whole field; the expense in staff and equipment to occupy the entire field would be very heavy, and it is doubtful whether the extra expenditure, at this epoch, would be socially justifiable. This particular complete range or organization of college teaching seems to be peculiarly the province of the state to support; and the state is already deeply engaged in the enterprise. By combining good agricultural work of a restricted kind with other nature-work, not eliminating other cultural studies, an endowed institution could make for itself a very useful place.

4. Long have I felt that a new kind of institution for agriculture, of very high grade, will some day arise on private endowment. This will be a coordinating and leadership institution, teaching advanced and special students in some subjects, engaging in research, but in the main making its contribution as a place for conference, for consideration of the large civic and social relations of rural life, and as a voluntary meeting-place on common and neutral ground for all the forces that lie in the situation. The state colleges of agriculture are coordinate with each other, they draw support from the same classes of funds, they come to have a comity of equality, they are all restricted in their outlook or at least in their practise by their necessary connections. We may be sure that there are bounds beyond which they may not go in making opinion on certain lines of great public questions. Government can not lead them: it can only supervise and regulate them.

I think I see the necessity for better opportunities than the land-grant or other state-maintained institutions are likely to give the freest men. Where shall we place our prophets? Separately they may accomplish much, but backed by facilities and a broad institution they may accomplish much more. One institution founded with

sympathy and on statesmanship could occupy a great place, if any board of governors were wise enough to avoid the cranks. It certainly would avoid all red-tape and all routine-men and all perplexing alliances. We may well look to government to coordinate the fiscal business and to some extent the projects of the public institutions, but we can not expect it to bring together the spiritual elements that alone can make a movement or a people great. Spiritual forces are always spontaneous.

I want to see at least one broad foundation, separately placed, certainly not in Washington, highly endowed, that will attract the best spirits somewhat independently of the subjects that they teach, to enable these men and women to give of themselves in a composite faculty, and to represent the best leadership in statecraft and other subjects as related to agriculture and country life. We are so accustomed to the formally regular program of the existing college of agriculture that an outline like this may seem to be indefinite and to lack cohesion, but it is not so very different from the old idea of a university; in fact, it might be known as a university founded on the earth, on rural life, with its students mostly graduates and not very numerous, with a good nature-background and not top-heavy with technical equipment.

### THE CONCLUSION OF THE WHOLE MATTER

My presentation is of four motives: (1) To extend the rural teaching, founded on agriculture, into general and liberal arts institutions, to the end that it may be made a means of culture, a force for training in citizenship, and a broadening influence in the institutions; (2) to indicate a way in which private endowments or enterprises of college and university grade may be hopefully made in agriculture; (3) to suggest the need of non-governmental movements which shall introduce into this field the same balance and counter-balance of forces that is essential in other fields for the maintenance of government that arises from the people, for not even in a democracy should all education be state-maintained; (4) to conserve the independence and the opportunities of the boldest prophets.

Of these motives, the last one I consider to be much the most important, the necessity to provide a footing for at least a few men without official attachments, of superior qualifications, and with an outlook covering the entire field.

The historian will discover this present segment of time to have been remarkable for its attainments with the products in agriculture. It is an epoch of wonderful horses, record-breaking cows, magnificent bulls, impeccable fowls; an epoch of marvellous fruits of the land, and of vast projects of reclamation. But the temper of the time begins to run out to the human factors, to the worth of the people in all the localities, to the little movements here and there that arise like springs in a fertile field. We just begin to glimpse something beyond us, as yet undefined; and presently our thought will begin to run backward to discover who were the men far in the generations behind us who saw something of this field and what they said about it, and what have been the rills of influence that have made the present current. We shall look forward for leaders, and shall discover that although we have had major prophets, not yet have we had a national figure.

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Such questions as these that we have raised, and many more of wide reach, must be discussed somewhere before representative gatherings. Shall it be here or elsewhere? This company comprises members of the Association and adherents of Section

M. What shall be the field and the function of this body? Shall it be strictly professional and official? Or shall it represent our democratic spirit and our forecast, introducing the element of public policy and prophecy even into technical discussion, bringing together the men and women from all sides and expressing all the work and movements? Our work is well under way. The morning hours are passed and the day is well toward noon.

L. H. BAILEY

## UNIVERSITY REGISTRATION STATISTICS

THE registration returns for November 1, 1915, of thirty of the universities of the country will be found tabulated on a following page. These statistics show only the registration in the universities considered. There is no intention to convey the idea that these universities are the thirty largest universities in the country, nor that they are necessarily the leading institutions.

The largest gains in terms of student units, including the summer attendance, but making due allowance by deduction for the summer session students who returned for instruction in the fall, are registered by California (2,375), Pennsylvania (900), Minnesota (892), Chicago (837), Columbia (594), and Pittsburgh (594), New York University (514), Ohio State (508), Illinois (486), Missouri (483), Cornell (412), Iowa State (370), Michigan (365), Northwestern (336), Cincinnati (334), Western Reserve (302).

The University of California shows a large gain of 2,375 students; no other institution shows a gain of more than 1,000 as against four last year. However, sixteen institutions (listed above) show gains of more than 300 as against fourteen last year and ten the year before. The fourteen institutions last year were Columbia, California, Pittsburgh, Ohio State, Wisconsin, Harvard, New York University, Minnesota, Pennsylvania, Illinois, Nebraska, Cornell, Cincinnati, and Michigan. Of these Wisconsin, Harvard and Nebraska are not included this year in the group, and Chicago, Missouri, Iowa State, Northwestern, and Western Reserve are included this year but were not last year.

Four institutions as against one last year show decreases in grand total attendance. They are Tulane, Washington University, Harvard and Princeton. Exclusive of summer sessions Western Reserve and Wisconsin show decreases, Washington University and Princeton not having summer sessions.

Omitting the enrollments in the summer session, the universities showing the largest gains for 1915 are Pennsylvania (916), Minnesota (739), Pittsburgh (594), Ohio State (502), New York University (438), Chicago (437), Illinois (374), California (363), Missouri (361), Cincinnati (334), Cornell (314), Michigan (299), Columbia (290), Nebraska (288), Harvard (274), Iowa State (255), Northwestern (208), Indiana (201). Eighteen show gains of more than 200 as against fourteen last year and twelve the year before last. Of the eighteen thirteen are in the west and far west and five are in the east. A similar list last year consisted of eight western and six eastern institutions.

According to the enrollment figures for 1915, the thirty institutions, inclusive of the summer sessions, rank as follows: Columbia (11,888), California (10,555), Chicago (7,968), Pennsylvania (7,404), Wisconsin (6,810), Michigan (6,684), New York University (6,656), Harvard (6,351), Cornell (6,351), Illinois (6,150), Ohio State (5,451), Minnesota (5,376), Northwestern (4,408), Syracuse (4,012), Missouri (3,868), Texas (3,572), Pittsburgh (3,569), Nebraska (3,356), Yale (3,303), Iowa State (3,138), Kansas (2,806), Cincinnati (2,524), Indiana (2,347), Tulane (2,160), Stanford (2,061), Western Reserve (1,825), Princeton (1,615), Johns Hopkins (1,586), Washington University (1,264), Virginia (1,008).

A comparison shows that the following eighteen universities hold the same relative positions (indicated by the numerals following the name) as was held last year. Columbia (1), California (2), Chicago (3), Cornell (9),

Illinois (10), Ohio State (11), Minnesota (12), Northwestern (13), Syracuse (14), Missouri (15), Texas (16), Nebraska (18), Iowa State (20), Kansas (21), Stanford (25), John Hopkins (28), Washington University (29), and Virginia (30). The other twelve institutions shift about as follows: Pennsylvania advances to fourth position, forcing Wisconsin back to fifth. Harvard, holding sixth position last year, falls back to the eighth, and Michigan and New York move up a notch. Pittsburgh formerly nineteenth, exchanges with Yale for the seventeenth position and Tulane drops back two places, thus advancing Cincinnati and Indiana. Western Reserve and Princeton change about.

If the summer session enrollment be omitted the universities in the table rank in size as follows: Columbia (7,042), Pennsylvania (6,655), California (5,977), New York University (5,853), Michigan (5,821), Illinois (5,511), Harvard (5,435), Cornell (5,392), Ohio State (4,897), Wisconsin (4,868), Minnesota (4,679), Chicago (4,324), Northwestern (4,153), Syracuse (3,830), Pittsburgh (3,569), Yale (3,303), Nebraska (3,067), Missouri (3,043), Iowa State (2,704), Texas (2,611), Cincinnati (2,524), Kansas (2,470), Stanford (2,048), Indiana (1,771), Princeton (1,615), Western Reserve (1,469), Tulane (1,321), Washington University (1,264), Johns Hopkins (1,173), Virginia (1,008).

A comparison shows that the relative positions of thirteen of the universities remain unchanged, and that the changes in the position of the remaining seventeen institutions involve only the shifting about of pairs—except in one instance. These shifts include the following, the first in each case having the advantage. New York and Michigan, Illinois and Harvard, Ohio State and Wisconsin, Pittsburgh and Yale, Cincinnati and Kansas, Indiana and Princeton, and Tulane and Washington. Northwestern is now thirteenth, Minnesota and Chicago advancing a step thereby.

Including the summer sessions the largest gains in the decade from 1905 to 1915 were made by Columbia (7,133), California (6,924), Pennsylvania (3,873), New York University (3,744) Wisconsin (3,727), Chicago (3,411), Ohio State (3,394), Illinois (2,515), Cornell (2,480), Texas (2,382), Michigan (2,163). The same group made the largest gains in the decade 1904 to 1914. Considering the gains in the last ten years of the thirty institutions, it is of interest to note that although the state institutions have had wide public attention because of their phenomenal growth a study shows that the other institutions of the group have also made noteworthy advances, approximately equalling in the aggregate the growth of the state universities.

Considering now the individual schools of the various universities, in the number of college undergraduates, California leads with 1,294 men and 2,023 women, followed by Harvard with 2,516 men and 653 women (Radcliffe College); Michigan with 1,986 men and 890 women; Minnesota with 993 men and 1,074 women; Chicago with 1,161 men and 851 women; Wisconsin with 850 men and 970 women; Columbia with 1,118 men and 656 women; Nebraska with 780 men and 826 women; Texas with 835 men and 767 women; Kansas with 873 men and 678 women; Iowa with 741 men and 762 women; Yale with 1,489 men; Indiana with 837 men and 597 women; Syracuse with 1,430 men and women; Missouri with 792 men and 588 women; Northwestern with 645 men and 711 women; Princeton with 1,306 men; Ohio State with 853 and 430 women; Stanford with 820 men and 401 women.

In engineering, Michigan now leads with 1,498 students followed by Cornell with 1,347, Illinois with 1,148, Yale with 1,039, Ohio State with 841, Wisconsin with 758, California with 712, Pennsylvania with 611, Minnesota with 578, Missouri with 564, Cincinnati with 474, and Stanford with 434. In law, Harvard holds the lead with 786 students, New York University with 726, Columbia with 471, Michigan with 431, Texas with 340, and Northwestern with 314 following in order.

The largest medical school is at New York University, where 509 students are now enrolled. Michigan has 378 students registered in medicine; California, 373; Johns Hopkins,

371; Tulane, 350; Harvard, 340; Pennsylvania, 340; Minnesota, 258; Northwestern, 238; Illinois, 226; Ohio State, 222; Texas, 216; and Chicago, 200. The non-professional graduate school of Columbia with 2,065 students is by far the largest. Chicago follows with 617; then Harvard with 587, California with 560, Pennsylvania with 548, Illinois with 403, Cornell with 395, New York University and Yale with 348 each, and Wisconsin with 322. Cornell continues to hold the lead in agriculture, with 1,608 students, followed by Illinois with 1,067, Wisconsin with 972, Ohio State with 970, Minnesota with 648, California with 581, Missouri with 560 and Nebraska with 512. The three universities reporting courses in architecture are Pennsylvania with 254 students, Illinois with 167, and Cornell with 166. The students in other institutions registered in architecture are listed in other schools of their respective universities. Washington University with 188 students leads in art, followed by Syracuse with 182, Nebraska with 65, Tulane with 61, Yale with 47, and Indiana with 43.

The school of commerce of New York University has 2,639 students. Pennsylvania's school follows with 1889 students, Pittsburgh's with 916, Northwestern's with 741, Wisconsin's with 542, Illinois' with 527, and California's with 308. Pennsylvania leads in dentistry with 744, followed by Northwestern with 666, Minnesota with 373, Michigan with 351, Iowa State with 303, Pittsburgh with 259, Harvard with 234. Of the four universities reporting schools of divinity, Northwestern has the largest with 196 students as against Chicago's 137, Yale's 105, and Harvard's 72.

The school of education at Columbia numbers this year 1,972 students as compared with 897 at Pittsburgh, 514 at Ohio State, 451 at Texas, 445 at New York University, 432 at Indiana, 413 at Cincinnati, 390 at Syracuse, and 352 at Chicago.

In forestry Syracuse leads with 292; then comes Ohio State with 44, Minnesota with 41, Yale 32 and Harvard with 4. New York University has the largest school of journalism with 151 students. Columbia follows with 143, Wisconsin with 116, Missouri with 94, Indiana with 75, and Texas with 46. With 86 students, Syracuse leads in library economy, followed by Illinois with 39, Wisconsin with 34, Western Reserve with 27, Iowa State with 20, and Indiana with 7. Syracuse also leads in music with 836 students enrolled. Northwestern reports 326, Kansas 110 and Texas 109. The pharmacy school of Columbia numbers 462. The next largest school is at Pittsburgh, where 240 are enrolled; then comes Illinois with 195, Western Reserve with 120, and Michigan with 114. The course in veterinary medicine at Ohio State numbers 160, at Cornell 145, and at Pennsylvania 144.

All of the above figures are for individual schools and colleges and are exclusive of the summer-session attendance. The largest summer-session in 1915 was at Columbia, where 5,961 students were enrolled. At California a phenomenal increase of 2,012 brought the enrollment of their summer-session to 5,364. Attendance at the summer-session of the University of Chicago was 4,369, at Wisconsin 2,780, at Michigan 1,677, at Cornell 1,509, at Texas 1,265, at Minnesota 1,141, at Missouri 1,135, at Pennsylvania 1,065, at New York 1,063, at Tulane 1,037, at Ohio State 1,029, and at Illinois 1,028.

The following paragraphs are explanatory of statistics appearing herewith with some additional information.

A study of the student enrollment in the scientific schools of mines, engineering and agriculture at Columbia University shows a steady decrease in enrollment corresponding to a steady increase of admission requirements now based upon a collegiate course of at least three years.

It is interesting to note that of the 1,608 students of agriculture at Cornell, 290 are women. There are seven women enrolled in the law school of that University, twenty-one in medicine, three in architecture, and one in mechanical engineering.

At the University of Cincinnati two years of college work has been added as a prerequisite for entrance to the school of household arts. This has resulted in a decrease of 42

| | California | Chicago | Cincinnati | Columbia | Cornell | Harvard (Inc. Radcliffe) | Illinois | Indiana | Iowa State | Johns Hopkins | Kansas | Michigan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| College, Men | 1294 | 1161 | 315 | 1118 | 1007 | 2516 | 599 | 833 | 741 | 321 | 863 | 1986 |
| College, Women | 2023 | 851 | 543 | 656 | 341 | 653 | 520 | 597 | 762 | ..... | 678 | 890 |
| Scientific Schools[1] | 712 | ..... | 474 | 341 | 1347 | 10 | 1148 | 389 | 245 | ..... | 386 | 1498 |
| Law | 158 | 235 | ..... | 471 | 234 | 786 | 86 | 98 | 153 | ..... | 166 | 431 |
| Medicine | 116 | 200 | 92 | 373 | 170 | 340 | 226 | 151 | 164 | 371 | 128 | 378 |
| Non-professional graduate Schools | 560 | 617 | 139 | 2065 | 395 | 587 | 403 | 92 | 158 | 239 | 108 | 267 |
| Agriculture | 581 | ..... | ..... | ..... | 1608 | ..... | 1067 | ..... | 94 | ..... | ..... | ..... |
| Architecture | 14 | ..... | ..... | 87 | 166 | 54 | 167 | 18 | ..... | ..... | 27 | [3] |
| Art[2] | [3] | ..... | 9 | ..... | ..... | ..... | [3] | 43 | 19 | ..... | 19 | ..... |
| Commerce | 308 | ..... | 196 | ..... | ..... | 179 | 527 | 116 | 100 | ..... | ..... | [3] |
| Dentistry | 141 | ..... | ..... | ..... | ..... | 234 | 127 | ..... | 303 | ..... | ..... | 351 |
| Divinity | ..... | 137 | ..... | ..... | ..... | 72 | ..... | ..... | ..... | ..... | ..... | ..... |
| Education | [3] | 352 | 413 | 1972 | ..... | ..... | [3] | 432 | 262 | ..... | 197 | [3] |
| Forestry | ..... | ..... | ..... | ..... | ..... | 4 | [3] | ..... | ..... | ..... | ..... | [3] |
| Journalism | ..... | ..... | ..... | 143 | ..... | ..... | [3] | 75 | 16 | ..... | ..... | [3] |
| Library Economy | ..... | ..... | ..... | ..... | ..... | ..... | 39 | 7 | 20 | ..... | ..... | [3] |
| Music | [3] | ..... | ..... | ..... | ..... | ..... | 59 | 77 | 80 | ..... | 110 | ..... |
| Pharmacy | 93 | ..... | ..... | 462 | ..... | ..... | 195 | ..... | 72 | ..... | 54 | 114 |
| Veterinary Medicine | [3] | ..... | ..... | ..... | 145 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Other Courses | ..... | 1020 | 749 | ..... | ..... | ..... | 349 | ..... | 96 | 286 | ..... | ..... |
| Deduct Double Registration | 23 | 249 | 406 | 646 | 21 | ..... | 1 | 1157 | 581 | 42 | 266 | 94 |
| Total | 5977 | 4324 | 2524 | 7042 | 5392 | 5435 | 5511 | 1771 | 2704 | 1173 | 2470 | 5821 |
| Summer Session 1915 | 5364 | 4369 | ..... | 5961 | 1509 | 916 | 1028 | 861 | 668 | 487 | 569 | 1677 |
| Deduct Double Registration | 786 | 725 | ..... | 1115 | 550 | ..... | 389 | 285 | 70 | 74 | 233 | 814 |
| Grand Total 1915 | 10555 | 7968 | 2524 | 11888 | 6351 | 6351 | 6150 | 2347 | 3138 | 1586 | 2806 | 6684 |
| Grand Total 1914 | 8180 | 7131 | 2190 | 11294 | 5939 | 6411 | 5664 | 2163 | 2768 | 1374 | 2650 | 6319 |
| Grand Total 1912 | 6457 | 6351 | 1924 | 9002 | 5412 | 5729 | 4315 | 2192 | 1944 | 1058 | 2403 | 5620 |
| Grand Total 1910 | 4552 | 5883 | 1416 | 7411 | 5169 | 5329 | 4659 | 2132 | 1957 | 890 | 2246 | 5339 |
| Grand Total 1905 | 3631 | 4557 | ..... | 4755 | 3871 | 5283 | 3635 | 1377 | 1700 | 688 | 1706 | 4521 |
| Extension and Similar Courses | 6859 | ..... | 322 | 4606 | 549 | 1300 | ..... | 339 | 16 | ..... | 725 | 350 |
| Officers and Instructional Staff | 587 | 315 | 300 | 995 | ..... | ..... | 657 | 202 | 298 | ..... | 218 | 565 |

[1] Includes Schools of Mines, Engineering, Chemistry and related subjects.

students. On the other hand the colleges of the university have shown a gratifying increase.

The decrease in registration at the University of Illinois, as in the case of other schools, is due to increased entrance requirements. Generally speaking, a decrease is almost certain when entrance requirements or tuition are increased. An increase in students following such action is the exception.

Connected with its college of liberal arts, the State University of Iowa has a department of graphic and plastic arts on the same basis as the departments of Latin, Greek, mathematics, etc., and courses in this department are offered toward a bachelor's degree. The school of music, by state action, has been made a department of the college, but not all of the courses are accepted toward a bachelor's degree. The course in journalism, the college of education and the school of commerce are in fact departments of the college of liberal arts. These have no separate faculty organization apart from the organization of the faculty of the college of liberal arts.

At Johns Hopkins University, large increases are noticeable in the "College Courses for Teachers" and in the junior courses. The reasons may be summarized as follows: The university has established the degree of Bachelor of Science in Education, and has opened the courses to students enrolled in other departments. The increase in the Summer Courses is due; first, to the addition, for the

| Minnesota | Missouri | Nebraska | New York University | Northwestern | Ohio State | Pennsylvania | Pittsburgh | Princeton | Stanford | Syracuse | Texas | Tulane | Virginia | Washington University | Western Reserve | Wisconsin | Yale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 993 | 792 | 780 | 597 | 645 | 853 | 528 | 439 | 1306 | 820 | 1430 | 835 | 239 | 522 | 201 | 418 | 850 | 1489 |
| 1074 | 588 | 826 | 242 | 711 | 430 | | 165 | ..... | 401 | | 767 | 226 | ..... | 271 | 440 | 970 | ..... |
| 578 | 564 | 317 | 270 | 98 | 841 | 611 | 314 | 134 | 434 | 285 | 283 | 136 | 114 | 171 | ..... | 758 | 1039 |
| 165 | 118 | 153 | 726 | 314 | 163 | 254 | 180 | ..... | 173 | 260 | 340 | 77 | 236 | 134 | 109 | 175 | 117 |
| 258 | 94 | 118 | 509 | 238 | 222 | 340 | 129 | ..... | 85 | 114 | 216 | 350 | 112 | 105 | 180 | 98 | 59 |
| 220 | 154 | 234 | 348 | 114 | 192 | 548 | 121 | 175 | 148 | 140 | 71 | 11 | 45 | 69 | 30 | 322 | 348 |
| 648 | 560 | 512 | ..... | ..... | 970 | ..... | ..... | ..... | ..... | 144 | 35 | ..... | ..... | ..... | ..... | 972 | ..... |
| 76 | ..... | ..... | ..... | ..... | 90 | 254 | ..... | ..... | ..... | 54 | 51 | 21 | ..... | 33 | ..... | ..... | ..... |
| ..... | ..... | 65 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 182 | ..... | 61 | ..... | 188 | ..... | ..... | 47 |
| ..... | 14 | 236 | 2639 | 741 | ..... | 1889 | 916 | ..... | ..... | ..... | 97 | 169 | ..... | ..... | ..... | 542 | ..... |
| 373 | ..... | 75 | ..... | 666 | 160 | 744 | 259 | ..... | ..... | ..... | ..... | 69 | ..... | 140 | 187 | ..... | ..... |
| ..... | ..... | ..... | ..... | 196 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 105 |
| 88 | 285 | 255 | 445 | ..... | 514 | 225 | 897 | ..... | ..... | 390 | 451 | 90 | ..... | ..... | ..... | 39 | ..... |
| 41 | [3] | ..... | ..... | ..... | 44 | ..... | ..... | ..... | ..... | 292 | ..... | ..... | ..... | ..... | ..... | ..... | 32 |
| ..... | 94 | ..... | 151 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 46 | 8 | ..... | ..... | ..... | 116 | ..... |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 86 | ..... | ..... | ..... | ..... | 27 | 34 | ..... |
| 73 | ..... | ..... | ..... | 326 | ..... | 27 | ..... | ..... | ..... | 836 | 109 | 29 | ..... | ..... | ..... | 82 | 98 |
| 99 | ..... | 52 | ..... | 71 | 94 | ..... | 240 | ..... | ..... | ..... | 52 | 13 | ..... | ..... | 120 | 36 | ..... |
| ..... | ..... | ..... | 26 | ..... | 160 | 144 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 22 | ..... | ..... | ..... | 276 | 263 | 1091 | ..... | ..... | ..... | 93 | 140 | ..... | ..... | ..... | ..... | 1 | ..... |
| 29 | 22[illegible] | 556 | 100 | 243 | 99 | ..... | 91 | ..... | 13 | 476 | 882 | 178 | 21 | 48 | 42 | 127 | 31 |
| 4679 | 3043 | 3067 | 5853 | 4153 | 4897 | 6655 | 3569 | 1615 | 2048 | 3830 | 2611 | 1321 | 1008 | 1264 | 1469 | 4868 | 3303 |
| 1141 | 1135 | 610 | 1063 | 359 | 1029 | 1065 | ..... | ..... | 77 | 311 | 1265 | 1037 | ..... | ..... | 361 | 2780 | ..... |
| 444 | 310 | 321 | 260 | 104 | 475 | 316 | ..... | ..... | 64 | 129 | 304 | 198 | ..... | ..... | 5 | 838 | ..... |
| 5376 | 3868 | 3356 | 6656 | 4408 | 5451 | 7404 | 3569 | 1615 | 2061 | 4012 | 3572 | 2160 | 1008 | 1264 | 1825 | 6810 | 3303 |
| 4484 | 3385 | 3199 | 6142 | 4072 | 4943 | 6504 | 2975 | 1641 | 1893 | 3913 | 3371 | 2441 | 902 | 1345 | 1523 | 6696 | 3289 |
| 3737 | 2871 | 2811 | 4543 | 3632 | 3608 | 5287 | 1883 | 1568 | 1670 | 3529 | 3016 | 2249 | 799 | 958 | 1378 | 5141 | 3265 |
| 4972 | 2678 | 2733 | 3947 | 3543 | 3181 | 5187 | ..... | 1451 | 1648 | 3248 | 2597 | 1985 | 688 | 796 | 1274 | 4745 | 3287 |
| 3940 | 1887 | 2635 | 2912 | 2791 | 2057 | 3430 | ..... | 1361 | 1606 | 2776 | 1190 | 838 | 696 | ..... | 856 | 3083 | 3477 |
| 1044 | 256 | 907 | 1732 | ..... | ..... | 665 | 500 | ..... | ..... | ..... | 1186 | 105 | ..... | 607 | 222 | 3798 | ..... |
| ..... | 302 | 506 | 490 | 480 | 481 | 600 | 395 | 232 | 363 | 315 | 237 | 342 | 112 | 218 | 261 | 685 | 616 |

[2] Includes painting and sculpturing.

[3] Included elsewhere.

first time, of graduate courses, for which credit may be secured towards the fulfillment of the requirements for the degree of Master of Arts; second, to the accrediting of the summer college courses toward the Bachelor of Science in Education degree (referred to above); third, to the establishment of a state law requiring attendance by state teachers upon a junior school; and fourth, to the permissible substitution of summer courses for attendance upon teachers' institutes.

The University of Michigan law school shows a loss of about fifty students due to a new requirement of two years of collegiate work for admission in place of the one year requirement which had been in force the previous three years. In the college of literature, science and the arts the gain was unexpected; the gain in women students being probably due to the opening of two new residences for women.

Part of the increase in the college of science, literature and the arts at the University of Minnesota is the result of an announcement of special courses arranged for the Twin City teachers which met with a gratifying response. The large increase in the college of dentistry is due to a dual freshmen enrollment, the last in the three-year course, and the first in a four-year course established this year. The maximum number of students were admitted to the freshmen class in the three-year course and

ninety students were admitted to the first-year class in the four-year course.

The large increase in registration in the scientific schools in the University of Missouri is due to the fact that beginning with the present year the school of engineering admits high-school graduates instead of requiring two years of college work for admission. No change has been made in the actual time required for securing the degree in engineering, but the first two years of the curriculum are now given in the school of engineering instead of in the college of liberal arts, resulting in a corresponding decrease, however, in the number of men in college. The professional schools show an increase, but the largest increase is in the school of education, due chiefly to the growing number of graduates of normal schools and colleges who continue their work in the university. A part of the development of the university in recent years has been due to a system of accredited junior colleges throughout the state.

The 645 men at the college of liberal arts of Northwestern University include 90 students in engineering who are registered for the bachelor's degree, and a small group of pre-legal students who are taking their first year's work in Evanston. Although the total number of students in the school of music shows a decrease, the enrollment of full time students is larger than last year.

The increase in entrance requirements to the professional colleges of law and medicine at Ohio State University naturally brought a loss in number, but this is also a part of the cause of a large increase in the college of liberal arts. The college of medicine now requires two years of academic work for admission, and has increased its curriculum from three to four years.

The summer school of the University of Virginia is conducted apart from the regular university session although credit is given by the university for certain work done. The summer school is one of several conducted in different parts of the state and had an enrollment in 1915 of 1,325.

The new summer school at Western Reserve opened with an enrollment of 361 students. The courses for teachers almost doubled in registrations over last year. The visiting nurses' class has five, and the course in advertising twenty-one.

The increase in the school of fine arts and music at Yale is probably due to conditions abroad which prevent students going to Paris, Berlin and other art centers. Although the total registration in the graduate school is less than last year, the number of candidates for the degree of master of arts and of doctor of philosophy is slightly increased.

John C. Burg
Northwestern University

## ACADEMIC FREEDOM AND ACADEMIC TENURE

The committee on academic freedom and academic tenure of the American Association of University Professors, of which Professor E. R. A. Seligman, of Columbia University, is chairman, presented its report at the annual meeting on January 1. The first part of the report (printed in *School and Society*) is a general declaration of principles, some twenty pages in length; the second part consists of practical proposals which are as follows:

As the foregoing declaration implies, the ends to be accomplished are chiefly three:

*First:* To safeguard freedom of inquiry and of teaching against both covert and overt attacks, by providing suitable judicial bodies, composed of members of the academic profession, which may be called into action before university teachers are dismissed or disciplined, and may determine in what cases the question of academic freedom is actually involved.

*Second:* By the same means, to protect college executives and governing boards against unjust charges of infringement of academic freedom, or of arbitrary and dictatorial conduct—charges which, when they gain wide currency and belief, are highly detrimental to the good repute and the influence of universities.

*Third:* To render the profession more attractive to men of high ability and strong personality by insuring the dignity, the independence and the reasonable security of tenure, of the professorial office.

The measures which it is believed to be necessary for our universities to adopt to realize these ends—measures which have already been adopted in part by some institutions—are four:

A. *Action by Faculty Committees on Reappointments.*—Official action relating to reappointments and refusals of reappointment should be taken only with the advice and consent of some board or committee representative of the faculty. Your committee does not desire to make at this time any suggestion as to the manner of selection of such boards.

B. *Definition of Tenure of Office.*—In every institution there should be an unequivocal understanding as to the term of each appointment; and the tenure of professorships and associate professorships, and of all positions above the grade of instructor after ten years of service, should be permanent (subject to the provisions hereinafter given for removal upon charges). In those state universities which are legally incapable of making contracts for more than a limited period, the governing boards should announce their policy with respect to the presumption of reappointment in several classes of position, and such announcements, though not legally enforceable, should be regarded as morally binding. No university teacher of any rank should, except in cases of grave moral delinquency, receive notice of dismissal or of refusal of reappointment, later than three months before the close of any academic year, and in the case of teachers above the grade of instructor, one year's notice should be given.

C. *Formulation of Grounds for Dismissal.*—In every institution the grounds which will be regarded as justifying the dismissal of members of the faculty should be formulated with reasonable definiteness; and in the case of institutions which impose upon their faculties doctrinal standards of a sectarian or partisan character, these standards should be clearly defined and the body or individual having authority to interpret them, in case of controversy, should be designated. Your committee does not think it best at this time to attempt to enumerate the legitimate grounds for dismissal, believing it to be preferable that individual institutions should take the initiative in this.

D. *Judicial Hearings Before Dismissal.*—Every university or college teacher should be entitled, before dismissal[1] or demotion, to have the charges against him stated in writing in specific terms and to have a fair trial on those charges before a special or permanent judicial committee chosen by the faculty senate or council, or by the faculty at large. At such trial the teacher accused should have full opportunity to present evidence, and, if the charge is one of professional incompetency, a formal report upon his work should be first made in writing by the teachers of his own department and of cognate departments in the university, and, if the teacher concerned so desire, by a committee of his fellow specialists from other institutions, appointed by some competent authority.

[1] This does not refer to refusals of reappointment at the expiration of the terms of office of teachers below the rank of associate professor. All such questions of reappointment should, as above provided, be acted upon by a faculty committee.

## SCIENTIFIC NOTES AND NEWS

AT the meeting of the Society of American Bacteriologists held at the University of Illinois at the end of December, Dr. Thomas J. Burrill, formerly vice-president of the university, was elected president of the society for the coming year.

DR. A. O. LOVEJOY, of the Johns Hopkins University, was elected president of the American Philosophical Association at the meeting held recently in Philadelphia.

DEAN FREDERICK J. WULLING, of the college of pharmacy of the University of Minnesota, has been elected president of the American Pharmaceutical Association.

AT the annual meeting of the Cosmos Club, Washington, D. C., on January 10, Dr. Hugh M. Smith, U. S. commissioner of fisheries, was elected president for the year 1916.

SIR ARCHIBALD GEIKIE, the distinguished geologist, celebrated his eightieth birthday on December 28.

THE ministry of public instruction of the French government has selected Dr. Wallace Clement Sabine, Hollis professor of mathematics and natural philosophy at Harvard University, as exchange professor with France for 1916–17. His term of service will fall in the winter semester and will be spent at the University of Paris.

DR. O. VAN DER STRICHT, professor of histology and embryology, University of Ghent, Belgium, has arrived from Holland to accept

the post of fellow in cytology in the medical school, Western Reserve University. Professor Van der Stricht will devote his time to research.

The Perkin medal of the Society of Chemical Industry will be presented to Dr. L. H. Baekeland on the evening of January 21 at a meeting held at Rumford Hall, the Chemists' Club, New York City. The address of presentation will be made by Dr. Charles F. Chandler, senior American past-president of the Society of Chemical Industry.

At the fifteenth annual meeting of the American Philosophical Association held at the University of Pennsylvania on December 28, 29 and 30, in honor of Professor Josiah Royce, of Harvard University, and, in celebration of his sixtieth birthday, the afternoon session on Tuesday and morning session of Wednesday were devoted to the reading and discussion of papers on his philosophy. The speakers at these sessions were Drs. John Dewey, H. H. Horne, R. C. Cabot, J. W. Hudson, M. W. Calkins, E. G. Spaulding, W. H. Sheldon, E. E. Southard and C. M. Bakewell. At the annual banquet on Wednesday evening the guest of honor was Professor Royce, who made the only address.

At the two hundred and ninety-first regular meeting of the Entomological Society of Washington the constitution was amended so as to permit the election of an honorary president, such office to be tendered only to active members who have been especially prominent in the affairs of the society and to convey with it expressions of gratitude, respect and honor. After creating this office, the society elected unanimously Mr. E. A. Schwarz as first honorary president. Mr. Schwarz was one of the charter members of the society, has held the office of president for two terms, vice-president for a number of terms and secretary for a number of terms and has taken an active interest in the affairs of the society. He has attended every meeting of the society when he has been in Washington, has contributed greatly to its financial support and has entertained the society more than any other member. He is an internationally recognized authority on Coleoptera and has contributed materially to the advancement of his favorite group and also to the general science of entomology.

At the seventh annual meeting of the American Phytopathological Society, held at Columbus, Ohio, from December 28 to 31, the following officers were elected: *President,* Dr. Erwin F. Smith, Bureau of Plant Industry, Washington, D. C.; *Vice-president,* Dr. Mel. T. Cook, New Jersey Agricultural Experiment Station, New Brunswick, N. J.; *Secretary-Treasurer,* Dr. C. L. Shear, Bureau of Plant Industry, Washington, D. C.; *Councilor,* Dr. F. D. Kern, Pennsylvania State College, State College, Pa. Dr. E. C. Stakman, Minnesota Agricultural College, Minneapolis, Minn., was elected a member of council vice Dr. Mel. T. Cook. Dr. W. A. Orton was elected one of the chief editors of *Phytopathology,* and Professor H. T. Gussow, Dr. C. W. Edgerton, Dr. E. C. Stakman and Dr. V. B. Stewart were elected associate editors.

At the annual meeting of the American Anthropological Association held in Washington, D. C., December 27–31, the following officers were elected for the year 1916: *President,* F. W. Hodge, Bureau of American Ethnology, Washington, D. C.; *Secretary,* George Grant MacCurdy, Yale University, New Haven, Conn.; *Treasurer,* Neil M. Judd, U. S. National Museum, Washington, D. C.; *Editor,* Pliny E. Goddard, American Museum of Natural History, New York, N. Y.

Dean Haskell, of the college of civil engineering of Cornell University, has been appointed a member of a board of consulting engineers which is to advise State Engineer Williams about the work of completing the New York barge canal.

The directors of the port of Boston have requested Professor C. M. Spofford, of the Massachusetts Institute of Technology, to act with Mr. Guy C. Emerson and the engineer of the board, Mr. F. W. Hodgdon, as consulting engineers on the construction of the great new dry dock. Already the port directors had

made arrangements with Professor E. F. Miller, head of the department of mechanical engineering, for the testing of materials to be used in construction.

DR. LYSANDER P. HOLMES, of the health department of New York City, has been appointed third assistant superintendent in the John Hopkins Hospital.

DR. GAIUS E. HARMON, instructor in hygiene and preventive medicine in the medical school of Western Reserve University, has been appointed assistant registrar of the Bureau of Vital Statistics to the Cleveland City Division of Health.

ON December 15, 1915, Dr. C. Stuart Gager addressed the Rhode Island Horticultural Society, at Providence, on the effects of electricity and radium-rays on the growth of plants.

THE Royal Institution, following an example set by many theaters in London, has arranged that for the present the discourses usually given on Friday evening shall be delivered at 5.30 P.M. The first was announced for January 21 by Sir James Dewar, on problems in capillarity; the second, by Dr. Leonard Hill on January 28, on the science of clothing and the prevention of trench feet; and the third, by Professor William Bateson, on February 4, on fifteen years of Mendelism.

A MEMORIAL service for the late Sir Henry Roscoe was held on December 22 at the Rosslyn Hill Unitarian Chapel. We learn from *Nature* that the Royal Society was represented by the president—Sir J. J. Thomson—Professor Arthur Schuster, Sir Edward Thorpe and Professor Smithells; University College (University of London) by the vice-chancellor, Sir Alfred P. Gould, Sir Thomas Barlow, Professor M. J. M. Hill (chairman of the academic council) and Dr. Gregory Foster (the provost); the Victoria University of Manchester by the vice-chancellor, Sir Henry Miers and Professor H. B. Dixon; the Chemical Society by Dr. Smiles and Professor J. C. Philip (secretaries), and Lieut.-Col. A. W. Crossley (foreign secretary); the Society of Chemical Industry by Sir Boverton Redwood and Mr. Watson Smith; the National Physical Laboratory by Dr. Glazebrook and Dr. Harker; the Lister Institute by Dr. Harden; the Royal Commissioners for the Exhibition of 1851 by Mr. Evelyn Shaw.

DR. B. L. MILLIKIN, M.D. (Pennsylvania, '79), former dean of the medical school, Western Reserve University, and senior professor of ophthalmology and senior consulting surgeon on eye diseases at Lakeside Hospital at the time of his death, died suddenly on January 6.

DR. GEORGE THOMAS JACKSON, formerly professor of dermatology at the College of Physicians and Surgeons, Columbia University, has died of pneumonia, at the age of sixty-four years.

DR. H. DEBUS, F.R.S., formerly professor of chemistry at the Royal Naval College, Greenwich, and lecturer on chemistry at Guy's Hospital, has died in his ninety-second year.

MR. W. RUPERT JONES, who was for forty years assistant librarian of the Geological Society of London, has died at the age of sixty years.

IT is reported that the commonwealth of Australia is prepared to expend whatever sum is necessary to establish and administer an institution for the development of scientific and industrial research, even if the cost amounts to half a million pounds.

WORK is now under way for the completion of the laboratory building and first range of plant houses at the Brooklyn Botanic Garden. The completion of these buildings at this time was made possible by the donation, by three friends of the garden, of $100,000 on the condition that a like sum be appropriated for the same purpose by the City of New York.

BY resolution of the board of directors it has been decided to name the new building of the University of Pennsylvania Museum the "Charles Custis Harrison Hall." This part of the museum consists of a dome which is unique in American architecture. The dome is 100 feet in diameter and 120 feet in height. In the lower part is an auditorium seating 1,000. Above this is an exhibition room, 100

feet in height. This Harrison dome cost $300,000, and will house some of the most important exhibits of the museum. It was named in honor of Dr. Harrison because its construction was largely due to his efforts.

The collection of gem-stones formed by the late Sir Arthur H. Church has, in accordance with a wish expressed in his will, been presented by his widow to the trustees of the British Museum, and is now on exhibition in the recent addition case in the Mineral Gallery of the Natural History Museum at South Kensington. It comprises about two hundred selected and choice faceted stones, most of them mounted in gold rings.

Mr. M. P. Skinner, a member of the American Museum, has presented to the institution some valuable motion-picture films and photographs of animals of the Yellowstone Park, obtained during his twenty years' experience in that region.

Loaned temporarily to the Archeological Museum of the Ohio State University for use during the convention of the American Association for the Advancement of Science were three private archeological collections. The owners are Henry F. Buck and F. P. Hills, of Sandusky, and D. C. Matthews, of Cleveland. Many interesting and valuable specimens were included in these collections, and they were of especial importance from a collector's standpoint. "The university museum attracted great interest during the convention," said Curator W. C. Mills. "Collectors from all over the country keenly enjoyed the displays set forth, and displayed interest in the lectures and talks." The Hyde collection, which was donated to the museum some time ago, is now installed and on exhibition.

The annual report of the committee on library of the New York Academy of Medicine, issued on January 1, shows a great decrease in the average of medical books published in Europe during 1915. During 1913 the academy received 704 French and German publications but during 1915 only 435.

At the ninety-seventh convocation recently held at the University of Chicago twenty-five students, nominated by the departments of science for evidence of ability in research work, were elected to the honorary scientific society of Sigma Xi.

On January 7, twenty-nine members of the faculty of the University of Missouri, belonging to the departments of history, sociology, anthropology, philosophy, psychology, education, economics, political science, law, etc., met and organized a new professional fraternity, Alpha Zeta Pi (Anthropos Zoon Politikon), for the promotion of the social sciences. While the present organization is a purely local one, the organizers have had in mind the possibility of similar societies in various institutions of the country getting together and forming a national organization with the same purpose. Alpha Zeta Pi will attempt to do for the social sciences what Sigma Xi is doing for the natural sciences. Students who have distinguished themselves in the university by giving special promise of future achievement in the social sciences, will be stimulated by being elected student members of the fraternity, and may later be elected permanent members. Both student members and permanent members will have equal rights in the fraternity. The fraternity will meet every month for the discussion of scientific problems. At the next meeting, in February, the first election of students (both graduate and undergraduate) to membership in the fraternity will take place. The officers for the present academic year are: *President,* M. F. Meyer; *Vice-president,* C. A. Ellwood; *Secretary-Treasurer,* J. E. Wrench.

Dr. John G. Bowman, of Chicago, director of the American College of Surgeons, states that the college begins the new year with the announcement that it has obtained from its fellows an endowment fund of $500,000, to be held in perpetuity, the income of which only is to be used in advancing the purposes of the college. The college has been in the process of formation for the last three years. It has a temporary office in Chicago and it is probable that permanent headquarters will be decided upon within a few days. The president

is Professor John Miller Turpin Finney, head of the surgical clinic of Johns Hopkins Hospital, Baltimore. It is modelled after the Royal College of Surgeons of England and has the support, it is said, of nearly all the leading surgeons in this country and Canada. "The college, which is not a teaching institution, but rather a society or a college in the original sense," Dr. Bowman says, "now lists about 3,400 fellows in Canada and in the United States."

DR. CHARLES P. STEINMETZ writes in the *Electrical World* that the Illuminating Engineering Society in 1916 celebrates the decennial of its existence. This will be an occasion to review and record what has been accomplished in the art and to initiate plans for future advance, and the society therefore expects a year of greater activity than ever before in all the field covered by it. The illuminating engineer has to deal not only with engineering, like other engineers—that is, with applied physics—but his work includes the problems and the knowledge of physiology and of psychology, is of importance to the ophthalmologist and to the sanitarian, and is closely related to that of the architect, the decorator and the constructor. It is one of the broadest fields of human activity, and it is hoped that the coming year will enable the society to produce a compendium of the entire field of the science and art of illumination and make it available to the practising engineer or architect as well as to the ophthalmologist, the college professor and the student. In celebration of the decennial of the society, a mid-winter convention will be held in February, with numerous technical papers, and the feature of this convention will be the acceptance of honorary membership in the society by the man who has made modern illuminating engineering possible, Thomas A. Edison.

IN addition to the collection of 20,000 vertebrate and 140,000 invertebrate specimens brought from Africa by the Lang-Chapin expedition, the evidence in the shape of photographs by Mr. Lang and colored drawings by Mr. Chapin is unusually varied and complete. Seven thousand photographs help to set forth the animal life of the Congo, as well as the industries, customs, art, ceremonies, amusements and mode of life of the natives; while the ethnological value of the work is supplemented by some seventy casts of heads which Mr. Lang was able to make through the consent of a tribe of Pygmies.

## UNIVERSITY AND EDUCATIONAL NEWS

MR. GEORGE T. BAKER has made a further gift of $50,000 to Cornell University.

BARNARD COLLEGE, Columbia University, has received $100,000 from Mr. James Talcott for religious instruction.

A NEW chair at the University of Pennsylvania to be known as the Dr. Isaac Ott chair in physiology, has been endowed through the legacy received from the estate of Dr. Isaac Ott, M.D., '69, of Easton, Pa. The legacy is subject to a life interest of Katherine K. Ott. Dr. Ott, who was a member of the American Physiological Society and a fellow of the American Association for the Advancement of Science, had made important contributions to our knowledge of the physiology and pathology of the nervous system.

ANNOUNCEMENT has been made of a fund established by Samuel Mather, of Cleveland, to found a school for the graduate study of tuberculosis as a memorial to the late Dr. Edward L. Trudeau. The school will probably be located at Saranac Lake, N. Y., and courses will be offered to physicians who wish to become proficient in the diagnosis of tuberculosis. Cooperating agencies for special study will also be established in New York City.

ON the thirteen acres of land lying adjacent to the campus which Western Reserve University has purchased, the erection of a complete new medical institution is contemplated. The present downtown school and hospital sites it is said will eventually be abandoned. Upon the same campus will be housed the dental and possibly the pharmacy schools, which

are at present affiliated with the university and located downtown. A new dental school building is about to be constructed.

THE sum of a quarter of a million dollars has been given by Mrs. Russell Sage to the Emma Willard School in Troy to found a department of domestic and industrial art to be known as the Russell Sage School of Practical Art. The new department will occupy the buildings recently vacated by the school on the completion of new buildings made possible by a gift of $1,000,000 from Mrs. Sage in 1907.

WE learn from *Nature* that Mr. Patrick Alexander, known by his pioneer work in aeronautics, has made over to the headmaster of the Imperial Service College, Windsor, the sum of £10,000 "for the furtherance of the education of boys of the Imperial Service College, *i. e.*, for the training of character and the development of knowledge." Mr. Alexander had given to the college an aero-laboratory and equipment about five years ago.

DR. IRVING E. MELHUS, formerly pathologist, office of cotton and truck diseases of the Bureau of Plant Industry, has assumed charge of the work in plant pathology in the Iowa State College.

## DISCUSSION AND CORRESPONDENCE

### GENETIC FACTORS AND ENZYME REACTION

IN spite of the great progress in the knowledge of facts in genetics the nature of genetic factors may well be regarded as unknown. Various theories have been proposed but only a few steps have been made to attack the problem experimentally. Those who approached it from the physiological-chemical side all seem to agree that the unit-factors are to be compared in some way to enzymes (Loeb, Robertson, Moore, Bateson, Riddle, etc.) or expressed more generally "that the hereditary factor . . . is a determiner for a given mass of certain ferments" (Loeb and Chamberlain, 1915).[1] At first sight there are not many ways visible of an experimental attack on this problem. One is described by Loeb and Chamberlain in the following words:

If we wish to carry this view (with which we sympathize) beyond the limit of a vague statement, we must either try to establish the nature of these compounds by the methods of the organic chemist, or we must use the methods of general or physical chemistry and try to find numerical relations by which we can identify the quantities of the reacting masses or the ratio in which they combine.

Some steps in this direction have been made by Loeb, Robertson and Ostwald, who tried to prove that the phenomena of growth may be understood as autocatalytic reactions; by Moore, who compared the velocity of development of a dominant character in homozygotes and heterozygotes; by Loeb and Chamberlain, who followed the more indirect way of proving the enzyme-reaction-like basis of a certain kind of fluctuating variability. It is further known that Miss Wheldale and Keeble are approaching the question by a direct study of the chemistry of plant pigments in hybrids of known constitution and quite recently a very interesting paper on hair-pigments in rodents has been published by Onslow.[2]

For some time I have had similar ideas in regard to these questions in connection with genetical experiments, approaching the subject from quite an unexpected side. It was not the intention to publish them before the entire work was finished. But as this will take some years longer and the subject is becoming meanwhile more popular, it might be advisable briefly to point out the ways in which I reached conclusions very similar to those of Loeb, etc.

The genetical reaction which is concerned primarily in my experiments is the pigmentation of the wings of moth. Its dependence upon genetic factors is well known and its chemical character—the amino-acid-oxydase reaction—is comparatively clear. In one set of experiments it could be shown how the quantity of pigment formation depends upon the quantitative combination of the hereditary factors.[3] The experiments were started in 1909 with the purpose of working out the genetics of melanism in moths. The experi-

[1] *Jour. Exp. Zool.*, Vol. 19, 1915.

[2] *Proc. R. Soc. S. B.*, Vol. 89, 1915.

[3] Onslow's results are in the same line.

ments are so far finished, but details about them can not be published, because the records are not available just now. But one point can be stated in a general way. In my example, the nun (*Lymantria monacha*), all gradations are found between a white animal with the characteristic zig-zag bands and a completely black one. The breeding experiments show that these intermediates are to be explained by combinations of some, partly sex-linked, factors for pigmentation. The comparison of the wings shows that the pigmentation starts from certain points of outlet and spreads thence over the wing, gradually encroaching upon the white scales. Obviously there corresponds to every combination of factors, an enzyme reaction, definite in quantity. Of course, the same conclusion could already have been drawn from Nilsson-Ehle's well-known studies on oats. But the meaning of the reaction is so much more evident in the insect case.

The other way which led to similar conclusions in regard to the connection of hereditary factors with the quantity of enzyme reaction is quite an unexpected one. In some previous papers I have published the results of experiments in determination of sex in the gypsy moth and a report upon their further progress is now in press in the *Proc. Nat. Acad. Sc.* The point which concerns us here is the following. We have found a series of races of that moth, which differ in regard to the quantitative behavior of their sex-factors. We could prove that in a cross between these races the resulting sex with all the secondary sex-characters depends upon the quantitative relation of the male and female set of sex factors. In the hybrids all kinds of combinations of these two sets varying in their relative quantity, can be brought together. And the result is that every single step between the two sexes, for which I proposed the term intersexes, may be produced. The external characters of these animals now are determined in the following way: the female factorial set would produce entirely female characters, and in the same way the male set male characters. The real effect is a function of the arithmetical difference of these two. If this difference is in favor of one or both above a certain quantity, say $f - m > x$ or $m - f > z$, the pure sex is produced. But if the difference is beyond the constant minimum $z$ and $x$, an intersex is produced. And the quantity of intersexuality increases proportionally to the decrease of the values $f - m$ or $m - f$. The effect of such a competition of two sets of factors, both influencing the same characters in different directions, is, of course, the same as if only one factor of a variable quantitative efficiency were present. And now we are able to draw a parallel between the quantities of the hereditary factor and the quantities of the observed enzymatic reaction causing the coloration of the wing.

In the colors and markings of the wings of these moths at least four factors or sets of factors are involved, as is shown by loss-mutations. The normal females have white wings with transverse zig-zag bands, and, in addition, a crescent-shaped spot and a point near it, resembling the Turkish emblem (crescent and star). In the males the same markings are present and also a diffuse color covering the entire wing and varying from light gray to almost black in different races. In a mutation, which appeared some years ago in my cultures, all ziz-zag bands, except the one near the edge of the wing, disappeared. The mutation is not sex-limited and independent of the general color of the wing as is shown by breeding tests. This general color is again subject to mutations in the male; and there appeared another mutation also in which the sex-linkage is broken and the female wings are colored. The following remarks apply only to the normal, general wing-pigmentation, linked with the male sex.

It is known through the work of Federley and others that this pigment flows out from the wing-veins spreading over the entire wing. And it might not be unsafe to say that it is the oxydase which diffuses from the hemolymph in the veins into the scales. If we now study the different grades of intersexuality produced in our experiments, we realize that every step leading from a normal female

through the different grades of intersexes to a male, or, vice versa, from a male to the female, is characterized by a definite intermediate step of wing-pigmentation. The color of the pigment is constant but its quantity is variable. And one sees at first sight that in the different intersexes a certain amount of pigment-producing oxydase, parallel to the quantitative behavior of the sex factors, is furnished by the veins, varying from 0 per cent. in the female to 100 per cent. in the male. If a male is becoming intersexual, white cunei appear between the veins on the brown wing. Their position and shape is irregular. The total unpigmented area in different animals of the same constitution, is, however, approximately the same. With growing intersexuality—as measured by all organs of the animal—the white spots become larger. And an inspection of the wings shows immediately that there must be present an amount of pigment or, more correctly, of oxydase, quantitatively fixed, and corresponding to the quantitative value of $m - f$; and that the given quantity (or concentration) flows out from the veins over the wing, producing brown scales, wherever it happens to come. With increasing inter-sexuality the phenomenon becomes still clearer. A stage is reached, where a white wing shows brown, pigmented venation; in some places a short stream of pigment seems to flow out from a vein. In still more advanced intersexual males, about two thirds transformed into females, only a few pigment spots and stripes are to be found on the wings along the veins. In the female intersexes the opposite process is observed, but the details are somewhat different, showing that these depend upon the genetically given wing structure, different in both sexes.

It seems that this case is an exceedingly clear one, demonstrating the principle ad oculos. But it may be of even greater significance. All organs different in the two sexes are affected in some way by the intersexuality. There is some hope that it might be possible to obtain by their analysis a similar insight in the process of growth, localization, symmetry, etc., involved in morphogenesis. But I think that it is already clear from the foregoing remarks, that we are right, when we reached, independently, the conclusion that the hereditary factor is a determiner for a given mass of ferments; and we can demonstrate it by the fact that a quantitative difference in the potency of hereditary factors causes a parallel, quantitatively different, enzyme production.

Richard Goldschmidt
Osborne Zoological Laboratory,
Yale University,
December, 1915

## EARLY MEETINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

To the Editor of Science: I am greatly interested in statistics published in your issue of December 3, in regard to the oldest members of the American Association for the Advancement of Science.

While my own membership dates only from 1870, my knowledge of and interest in the association far antedates that year. It seems almost certain that I have known the association by attending its meetings longer than any other person now living.

In 1851, Professor James H. Coffin, of Lafayette College, was a guest at our home in Albany and took me to the meeting in the old capitol.

Again in 1856 he was our guest. I was then a pupil at the Albany Academy, a building of historic interest as the place where Joseph Henry installed the first telegraph. One of the sessions of the association was held in the academy park, at which the Dudley Observatory was dedicated. I well remember the delight with which we watched Professor Agassiz draw figures with both hands while he talked; also the eloquent address of Edward Everett.

Wm. H. Hale
40 First Place, Brooklyn, N. Y.

## SCIENTIFIC BOOKS

*The Alligator and Its Allies.* By Albert M. Reese, Ph.D., Professor of Zoology in West Virginia University. New York, G. P. Putnam's Sons, 1915. Pp. xi + 342. 62 figures and 28 plates.

The purpose of this volume, as stated in the preface, is "to bring together, in convenient form for the use of students of zoology, some of the more important details of the biology, anatomy and development of the Crocodilia." There are chapters on the biology of the Crocodilia, the skeleton, the muscles, the nervous system, the vascular system, the urogenital system, the respiratory system, the vascular system, and the development of the alligator, and a bibliography containing eighty-nine titles. The book is illustrated by sixty-two figures, about half of them original, and twenty-eight plates. all but six of which are original.

In the chapter on the biology of the Crocodilia, the classification and geographical distribution are briefly summarized, evidently from general works, brief notes on the characteristics of several forms are given, and twenty-nine pages are devoted to a discussion of the habits and economic importance of *Alligator mississippiensis,* principally as revealed in the writer's field work. The description of the muscular system is a translation of Bronn's account of the muscles of *Crocodilus,* with illustrations of the musculature of *Crocodilus* and *Alligator,* and the description of the nervous system is taken from Bronn and others. The description of the digestive, urogenital, respiratory, vascular and skeletal systems are original, as is the account of the embryological development of *Alligator mississippiensis,* the last being a reprint, with some alterations, of an earlier paper by the author published by the Smithsonian Institution.

The author has succeeded in his expressed purpose of making the book detailed, and it will at once find a place in the library of the comparative anatomist and herpetologist as a valuable reference work. In the opinion of the reviewer the only serious adverse criticism which will probably be made by students is that the chapter upon the embryological development of the alligator is too detailed. A connected and more readable account of the embryology would be of more general value than will be the monotonous descriptions of sections which make up this chapter. It is stated in the publisher's advertisement on the jacket that the book "has an assured appeal for the layman interested in natural history," but this is doubtful, for, in addition to the detailed treatment, the terminology is technical and about seven eighths of the text consists of descriptions of the anatomy and embryology.

ALEXANDER G. RUTHVEN
MUSEUM OF ZOOLOGY,
UNIVERSITY OF MICHIGAN

## PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES
(NUMBER 12)

THE twelfth number of volume 1 of the *Proceedings of the National Academy of Sciences* contains the following articles:

1. *Salts, Soil-Colloids and Soils:* L. T. SHARP, College of Agriculture, University of California.

New light is thrown upon the subject of salts in relation with soil-colloids. The way is opened for extensive experiments in the physical chemistry of soils, and the principles involved will be of particular significance for the subject of the applications of alkali and of fertilizer salts.

2. *The Child and the Tribe:* ALICE C. FLETCHER, Peabody Museum, Harvard University.

The rites connected with the initiation of the child into the tribal life are described with emphasis upon their significance in Indian education and philosophy.

3. *The Correlation of Potassium and Magnesium, Sodium and Iron, in Igneous Rocks:* HENRY S. WASHINGTON, Geophysical Laboratory, Carnegie Institution of Washington.

The author's earlier suggestion that soda not uncommonly tends to vary with the iron oxides while potash shows similar relations to magnesia is greatly strengthened by a compilation of analyses of igneous rocks, numbering nearly 10,000.

4. *Theorem Concerning the Singular Points of Ordinary Linear Differential Equations:* GEORGE D. BIRKHOFF, Department of Mathematics, Harvard University.

It is shown that transformations of the independent variable have no significance over and above linear transformations of the dependent variables for the purposes of classification with respect to the notion of equivalence.

5. *A Quantitative Study of Cutaneous Analgesia Produced by Various Opium Alkaloids:* David I. Macht, N. B. Herman and Charles S. Levy, Pharmacological Laboratory, Johns Hopkins University.

By the use of exact experimental methods the order of analgesic power in the individual alkaloids from strongest to weakest is found to be: Morphin (10 mg.), papaverin (40 mg.), codein (20 mg.), narcotin (30 mg.), narcein (10 mg.), thebain (10 mg.). The combinations of alkaloids are also studied.

6. *The Surface-Tension at the Interface between Two Liquids:* William D. Harkins and E. C. Humphrey, Kent Chemical Laboratory, University of Chicago.

The substitution of experiments on the liquid-liquid interface for the ordinary method in which a liquid-air interface is used, makes it possible to compare the drop-weight results with those obtained in a capillary tube of large bore. Various advantages appear from the use of this method.

7. *Outlines of a Proposed System of Classification of the Nebulæ by Means of Their Spectra:* W. H. Wright, Lick Observatory, University of California.

The spectra are arranged according to the degree of concentration of 4686A and some of the neighboring lines. The successive nebulæ stand in very close relation to one another, yet at one end of the scale is a purely gaseous nebula, and at the other end a banded star.

8. *Some Probable Identities in Wave-Length in Nebular and Stellar Spectra:* W. H. Wright, Lick Observatory, University of California.

The evidence renders probable the presence in the nebulæ of carbon and nitrogen and fortifies the assumption of a close relationship between the nebulæ and the early type stars.

9. *Energy Transformations During Horizontal Walking:* Francis G. Benedict and Hans Murschhauser, Nutrition Laboratory, Carnegie Institution of Washington.

The metabolism found for the subject walking at moderate speed without food has an average value of ½ gram-calorie. Slow, medium, and fast walking and running are investigated for comparison.

10. *The Physiology of the New-Born Infant:* Francis G. Benedict and Fritz B. Talbot, Nutrition Laboratory, Carnegie Institution of Washington.

The results of experiments on 105 new-born infants give opportunity for suggestions as to supplemental feeding and methods of conserving energy.

11. *A Comparison of Methods for Determining the Respiratory Exchange of Man:* Thorne M. Carpenter, Nutrition Laboratory, Carnegie Institution of Washington.

The apparatus compared were the following: bed respiration calorimeter; two forms of the Benedict universal respiration apparatus; Zuntz-Geppert apparatus; Tissot apparatus; and so on.

12. *Neuro-Muscular Effects of Moderate Doses of Alcohol:* Raymond Dodge and Francis G. Benedict, Nutrition Laboratory, Carnegie Institution of Washington.

Contrary to the theory of Kraepelin, the authors find no facilitation of the motor processes, but the depression of their simplest forms in the finger and eye movements seem to be one of the most characteristic effects of alcohol.

13. *Variation and Inheritance in Abnormalities Occurring after Conjugation in Paramecium Caudatum:* Ruth J. Stocking, Zoological Laboratory, Johns Hopkins University.

In respect to the abnormalities, while some lines are constant in hereditary character, in others hereditable variations do occur within the line, so that, by selection, it is possible to break the single stock into a number of stocks differing hereditarily.

14. *The Influence of the Marginal Sense Organs on Functional Activity in Cassiopea Xamachana:* Lewis R. Cary, Department of

Biology, Princeton University.

There is no direct relationship between the extent of muscular activity and the rate of regeneration. In the absence of the influence of the sense-organs regeneration can take place normally but always at a decidedly lower rate.

15. *Heritable Variations and the Results of Selection in the Fission Rate of Stylonychia Pustulata:* AUSTIN RALPH MIDDLETON, Zoological Laboratory, Johns Hopkins University.

It is possible to give precise data as to the occurrence of heritable variations and their accumulation through selection: and this can hardly fail to have influence on the conception of the genotype as a fixed thing.

16. *Hereditary Anchylosis of the Proximal Phalangeal Joints (Symphallangism):* HARVEY CUSHING, Harvard Medical School and Peter Bent Brigham Hospital, Boston.

The character behaves as a simple Mendelian dominant with equal chance among the offspring of affected individuals that it will be or will not be inherited.

17. *The Relative Stimulating Efficiency of Spectral Colors for the Lower Organisms:* S. O. MAST, Zoological Laboratory, Johns Hopkins University.

The stimulation in all of the organisms studied depends upon the wave-length of the light, and the stimulating efficiency is very much higher in certain regions of the spectrum than in others, but the regions differ in certain organisms closely related in structure.

18. *The Mission Range, Montana:* W. M. DAVIS, Department of Geology, Harvard University.

This range seems unique in its systematic tripartite arrangement of normally and glacially sculptured forms.

19. *Definition of Limit in General Integral Analysis:* ELIAKIM HASTINGS MOORE, Department of Mathematics, University of Chicago.

The definition is noteworthy in that it involves no metric features of the range $\mathfrak{P}$ underlying the range of definition of the function $F(\sigma)$.

This number of the *Proceedings* contains also a notice of the memoir by Charles C. Adams on "The Variations and Ecological Distribution of the Snails of the Genus *Io*"; the Report of the Autumn Meeting, and the Index and Table of Contents of the complete volume, including a list of the officers and members of the academy.

We may summarize the articles in Volume 1 of the *Proceedings* as follows: Mathematics, 21; Astronomy, 31; Physics, 7; Chemistry, 21; Geology and Paleontology, including Mineralogy and Petrology, 10; Botany, 4 (see also Genetics); Zoology, 15 (see also Genetics); Genetics, 17; Physiology and Pathology, including Bacteriology, 24; Anthropology, 12; Psychology, 3; a total of 165 articles.

The division of these articles between members of the academy and non-members is 55 and 110, respectively.

The list of institutions which have contributed three or more articles is as follows: Carnegie Institution 34, divided as follows: Solar Observatory 17, Nutrition Laboratory 9, Station for Experimental Evolution 5, Marine Biology 2, Geophysical Laboratory 1; University of Chicago 20; University of California 17; Harvard University 16; Johns Hopkins University 11; Rockefeller Institute 11; University of Illinois 8; Yale University 6; Princeton University 5; Smithsonian Institution 4; U. S. National Museum 4; Stanford University 4; American Museum of Natural History 4; U. S. Geological Survey 3.

EDWIN BIDWELL WILSON

## RECENT PROGRESS IN VERTEBRATE PALEONTOLOGY

THREE years ago the Paleontological Society of America published a symposium, the purpose of which was to present a review of the progress made during the preceding decade in paleontology. Since 1911 there have been published in the American Year Book brief summaries of the more important results of investigation in this field throughout successive years. The extreme brevity of these reviews has rendered them less useful to students than

might have been the case had they been accompanied by critical notes, or had they been prepared with the same fulness as Dr. Lydekker's valuable discussions in Science Progress for the last few years. It is hoped that the following account of the year's achievements in the field of vertebrate paleontology may, in a measure, supply the deficiency which has heretofore existed.

*Fishes.*—Owing to the stress of conditions abroad, it is natural that the chief advance in vertebrate paleontology since the war began should have been made in this country. Nevertheless, several very important contributions by foreign authors are to be recorded. Among the latter may be mentioned Dr. A. S. Woodward's generalizations on the evolutionary history of the class of fishes, as contained in his anniversary address before the Geological Society of London (February 19, 1915). The net result of this author's observations is thus formulated:

> Each successive great group of fishes began with free-swimming fusiform animals. . . . Some of them always passed quickly into slow-moving (deep-bodied or grovelling, depressed and large-headed) types, while others changed more slowly into elongated or eel-shaped types. There was also a constant tendency for the primitive symmetry of the parts of the skeleton in successive members of a group to become marred by various more or less irregular fusions, suppressions and subdivisions. Finally, some of the successive species of each group gradually increased in bodily size until the maximum was reached, just before the time for extinction had arrived. These and many other more special changes have now been traced in a general way in each group, and the various geological periods at which they occurred have been determined by observations on fossil fishes from many parts of the world.

Professor F. Priem, of Paris, presents a valuable account of the Cretaceous and Eocene fishes of Egypt,[1] and has continued his studies on Upper Tertiary fish remains from southwestern France.[2] Dr. Edward Hennig, of the Berlin Museum, reports the interesting discovery of otoliths in the type species of *Palæoniscus,* from the Permian of Saxony. A note on the parasphenoid bone of the same genus, by Henry Day,[3] contains observations which lead the author to conclude "in favor of a primitive Teleostome, and against a Dipnoan, derivation of the Tetrapoda." African fossil fishes form the subject of two contributions by Edward Hennig,[4] and a further one by Ernst Stromer von Reichenbach,[5] of Munich.

In this country Dr. R. L. Moodie,[6] of the University of Illinois, has reinvestigated the fossilized brain-structure and auditory organs of a small Palæoniscid species, *Rhadinichthys deani,* first described by Eastman and Parker from specimens found in the Waverly of Kentucky. Similar remains are also reported from the Caney shale of Oklahoma, and the Pennsylvanian of Lawrence, Kansas. The same author also reviews the literature relating to fossil brain casts of dinosaurs and other extinct animals. Some additions to our knowledge of the Jurassic fish-fauna of Solenhofen and Cerin, France, are made by C. R. Eastman in his studies of Carnegie Museum material.[7]

Dr. W. K. Gregory,[8] of the American Museum of Natural History, presents a concise review of the evolutionary history of the principal groups of fishes, with special reference to the skull and locomotor organs. He brings together considerable evidence for the view that certain of the Devonian Crossopterygii were related to the four-footed terrestrial vertebrates, and attempts to trace the gradations by which the pectoral and pelvic fins of these fishes were transformed into the fore and hind limbs of the earliest amphibians.

[1] *Bull. Soc. Geol. France,* Vol. 14, pp. 366–382, pl. X.

[2] *Ibid.,* pp. 119–131; 249–278.

[3] *Ann. Mag. Nat. Hist.,* Vol. 16, pp. 421–434.

[4] *Archiv. f. Biontologie,* Vol. 3, pp. 291–312. This is on fish remains obtained by the Tendaguru expedition. The second paper, on *Semionotus* from South Africa, is published in the *Sitzber. Ges. Naturf. Freunde Berlin,* 1915, pp. 49–51.

[5] *Zeitschr. Deutsch. Geol. Ges.,* Vol. 66, pp. 420–425.

[6] *Jour. Compar. Neurology,* Vol. 25, No. 2.

[7] *Mem. Car. Mus.,* Vol. 6, Nos. 6, 7.

[8] *Annals N. Y. Acad. Sci.,* Vol. 26, pp. 317–383, pl. IV.

*Amphibians.*—Professor S. W. Williston,[9] of the University of Chicago, in his discussion of the genus *Trimerorachis,* from the Permian of Texas and Oklahoma, argues that this interesting animal, which is in some respects more fish-like than any other known amphibian, represents a secondary adaptation to aquatic habits, and that its ancestors were more terrestrial, and therefore less pisciform in structure and habits. Dr. Carl Wiman,[10] of Upsala, has published an important memoir on the abundant Stegocephalians of the Trias of Spitzbergen, which, as remarked by Broili, were probably marine animals.

Dr. F. Broili,[11] of Munich, contributes an interesting discussion of *Tanystrophæus conspicuus* von Meyer from the Muschelkalk of Bayreuth, an animal known from certain excessively elongate caudal vertebræ. The author adopts as most probable Cope's sagacious determination of these strange vertebræ as representing a small Theropodous dinosaur, an opinion also adopted by Baron von Huene.

Dr. R. L. Moodie[12] describes a remarkable amphibian from the Pennsylvanian of Ohio which combines early amphibian and reptilian characters in the limbs. The same author, in describing the scales of certain Carboniferous amphibians[13] comments on their resemblances to and differences from the scales of fishes. In the *Kansas University Science Bulletin* Dr. Moodie gives a list of the described species of fossil amphibians, comprising more than 300 entries. Again, in the September number of the *American Naturalist,* the same author contrasts the amphibians of the Coal Measures with their supposed relatives among fringe-finned ganoids, and shows that even at that remote period the Amphibia and Crossopterygii were structurally far removed from each other; so that their common ancestors, if any such existed, must be sought in some much earlier period.

[9] *Jour. Geol.,* Vol. 23, pp. 246–255.

[10] *Bull. Geol. Inst. Upsala,* Vol. 13, 9 plates and 10 figs.

[11] *Neues Jahrb. Mineral.,* Jahrg. 1915, Vol. 2.

[12] *Amer. Jour. Sci.,* Vol. 29.

[13] SCIENCE, March 26, 1915.

Professor E. C. Case, of the University of Michigan, contributes an important memoir on the Permo-Carboniferous Red Beds of North America and their Vertebrate Fauna.[14] He describes the geological structure and relations of these beds, the character of the environment, and discusses the life habits and appearance of many of the fossil amphibians and reptiles found there, giving restorations of a score of these strange creatures.

*Reptiles.*—Dr. R. Broom, of London, has prepared an illustrated catalogue of the Permian Triassic and Jurassic reptiles of South Africa.[15] This collection was made by Dr. Broom in South Africa and purchased from him by the American Museum of Natural History; it includes a large series of skulls and partial skeletons, representing many genera and families of the mammal-like reptiles (Therapsida). The same author in his Croonian lecture on the Origin of Mammals[16] discusses the anatomical evidence for the derivation of the mammals from one or another of the Therapsid group, especially the earlier Cynodontia, which are the most mammal-like of all the South African reptiles.

D. M. S. Watson, of University College, London, in the *Proceedings of the Zoological Society of London,* December, 1914, describes and analyzes the skull structure of *Bauria, Microgomphodon, Arctops* and other important South African Permian types. These researches are all in harmony with the now widely held view that the mammals have arisen from some of these mammal-like reptiles, but the connecting links have not yet been discovered. In another paper[17] Watson describes the anatomy of the Deinocephalia, one of the most curious of the South African groups. Some of these animals were of huge size, with massive limbs and an arched back, like a gigantic *Echidna,* but with a swollen, short-beaked skull.

[14] Carnegie Inst. Washington, Pub. No. 207.

[15] *Bull. Amer. Mus. Nat. Hist.,* Vol. 25, Part 2.

[16] *Phil. Trans. Roy. Soc. London,* 1914, Vol. 206 *B.*

[17] *Proc. Zool. Soc. London,* September, 1914.

Mr. Watson has also described[18] a peculiar Permian South African reptile named by Seeley *Eunotosaurus africanus,* which appears to give the long-sought clue to the origin of the Chelonia. The turtles and tortoises, it will be remembered, are the only vertebrates in which the pelvis and shoulder-girdle have been drawn inward under the expanded and projecting ribs. In *Eunotosaurus,* the ribs are expanded and of the same number as in the Chelonia, while the back was armored with dermal scutes of similar number and position; but the shoulder-girdle and pelvis still retain their primitive positions and the skull also retained teeth, which are lost in the Chelonia.

In this connection must be recorded a work by Professor Hugo Fuchs, of Strassburg, on the structure and development of the skull of *Chelone imbricata,* the first part of which, on the cartilage skull and visceral arches, is a quarto of 325 pages, 6 plates and 182 text figures (Stuttgart, 1915). Here are discussed many far-reaching morphological questions such as the derivation of the lateral wings of the sphenoid bone and the origin of the mammalian auditory ossicles.

The latter subject, after nearly a century of discussion, has of late years received special illumination from the investigations of Professor Gaupp, of Freiburg, who has ably supported Reichert's view that the mammalian incus has been derived from the reptilian quadrate, the malleus from the articular. Reichert's theory has encountered certain objections based upon supposed differences in the position of the auditory ossicles with reference to the hyoidean gill slit and to the chorda tympani nerve in reptiles, birds and mammals. Mr. E. S. Goodrich, of Merton College, Oxford, has definitely cleared up this intricate matter in a superb series of figures showing the developmental relations of the chorda tympani in the different classes of vertebrates. His results lend very strong support to Reichert's theory.[19]

In a memoir entitled "Triassic Life of the Connecticut Valley"[20] Professor R. S. Lull, of Yale University, gives a highly readable biological and geological account of the Connecticut Valley during the Triassic Period and of its teeming inhabitants, especially the dinosaurs. The later dinosaurs have been the subject of important contributions by several American authors whose papers may be noted as follows:

Mr. C. W. Gilmore,[21] of the U. S. National Museum, has given a very thorough and well illustrated description of the osteology of *Stegosaurus* based upon the skeleton and other specimens in the U. S. National Museum. Briefer notices by the same author[22] are upon the restoration of *Stegosaurus* and upon the fore-limb of *Allosaurus,* the latter settling a problem that had been a standing annoyance and cause of confusion in dinosaur paleontology of the last thirty years.

Dr. W. J. Holland[23] has published some preliminary results of his researches upon the magnificent series of Sauropodous dinosaurs secured in Utah by Mr. Earl Douglass for the Carnegie Museum. He finds that the skull referred by Marsh to *Brontosaurus* is probably wrongly collated, the true skull of this genus being much nearer the *Diplodocus* type. The tail of *Brontosaurus* he finds, like that of *Diplodocus,* ends in a long slender whip-lash and is at least ten feet longer than the published reconstructions have indicated.

Mr. Barnum Brown and Lawrence M. Lambe have published a number of highly important articles descriptive of the magnificent series of dinosaur skulls and skeletons obtained from the Cretaceous of Alberta by Mr. Brown for the American Museum of Natural History and by Mr. Sternberg for the Victoria Museum in Ottawa, Canada.

Dr. Edward Hennig,[24] of the Berlin Mu-

[18] *Proc. Zool. Soc. London,* December, 1914.

[19] *Quarterly Journal of Microscopical Science,* 1915.

[20] Bulletin No. 24, State Geol. and Nat. Hist. Survey Connecticut.

[21] *Bull. U. S. Nat. Mus.,* No. 89, December 31, 1914, p. 147.

[22] *Proc. U. S. Nat. Mus.,* 1915, Vol. 49, pp. 355–356, pl. 52; *ibid.,* pp. 501–513.

[23] *Annals Carnegie Mus.,* Vol. IX., pp. 273–278.

[24] *Sitzber. Ges. Naturf. Fr. Berlin,* 1915, pp. 203–247.

seum, has described and figured various skeletal bones of the new armored dinosaur whose remains are found in great numbers in the Tendaguru dinosaur quarries of German East Africa. He points out its marked differences from *Stegosaurus,* compares it more slightly with the European genera *Omosaurus, Polacanthus,* etc., and describes it as new under the (unfortunately preoccupied) name of *Kentrosaurus.*

A handbook on Dinosaurs by Dr. W. D. Matthew published by the American Museum of Natural History describes and illustrates the principal exhibits in this museum and discusses their characteristics, and the place in nature occupied by this extinct order of reptiles.

*Mammals.*—Progress in this branch of vertebrate paleontology during the past year has been mainly in continuance of researches, presenting few salient points of interest. The most important contributions of the year on fossil mammals deal with the order Primates, and there should be mentioned first of all those relating to primitive man. In our own language three books have appeared during the year which treat of prehistoric human remains; of these the foremost place must be accorded to Professor Henry Fairfield Osborn's "Men of the Old Stone Age," which presents in accurate and very interesting style the latest results of scientific research upon the environment, habits and art on paleolithic man. "The Antiquity of Man," by Mr. Arthur Keith, sets forth with admirable lucidity and literary style the somewhat extreme views of its distinguished author upon the great antiquity of the modern types of man and his early divergence from the remaining primate stems. The third volume, "Prehistoric Man and His Story," by Dr. Scott Elliott, includes excellent photographs of the remarkable series of statuettes representing primitive and ancestral types of man executed under direction of Professor Rutot. It can not be said to rank with the two first-mentioned books in authority, the Tertiary paleontology and American archeology being especially weak.

A most important contribution has been added by Gerritt S. Miller[25] to the controversy that has raged around the famous Piltdown skull. Dr. Miller analyzes with care the evidence for and against the association of the skull fragments with the lower jaw and compares the latter with a large series of chimpanzee jaws in the National Museum. He comes to the conclusion that the jaw is in every respect within the limits of individual variation of the chimpanzees, and displays no distinctively human characters, while the skull fragments display in every particular the characters of the genus *Homo.* Not only is there an entire lack of blending of these two distinct types of skull, but in such parts as should show coordinated characters and adjustment of one to the other, such conformity is wholly lacking.

In the present reviewer's opinion [W. D. M.] Dr. Miller's argument is convincing and irrefutable; the jaw belonged to a chimpanzee and the skull to a species of man comparable with that represented by the Heidelberg jaw. It is hardly to be expected, however, that this conclusion will be readily accepted by the European writers, who have with but few exceptions committed themselves more or less deeply to the opposite view.

It is quite true, as Professor Boule has observed, that nature affords many instances of unexpected combinations of different types, and no one need be surprised to see an ape-like dentition combined with a man-like brain-case. Indeed, Elliott Smith has adduced excellent reasons why we may well expect to find such a combination. But it is necessary here to distinguish between the concepts of resemblance and identity. The Piltdown jaw is *not* simply a jaw similar in adaptive specialization to that of an ape, it is a jaw identical with that of the chimpanzee in every particular. The skull is not merely similar in brain-case to that of man, it is the skull of *Homo* in every particular. For such a combination as this, with its

[25] *Smithson. Misc. Coll.,* Vol. 65, No. 12.

utter lack of blending, correlation or coordination of interrelated parts, one set of fragments identical with one, the other set identical with another animal of diverse type, not merely similar each to each—such a combination is without parallel and is not reasonably possible. To cite a familiar instance, the teeth of the chalicotheres have a general adaptive resemblance to the titanotheres, the skull and neck to the horses, the claws to the edentates. This is a combination quite unexpected, but nevertheless a quite possible one, and of course well proven. But if one should find a jaw identical in every particular with that of a titanothere associated with a cranium identical in every way with that of *Equus* and claw-phalanges agreeing in all respects with *Mylodon,* it would not be reasonably possible that they could belong to a single animal, no matter what arguments of association and distribution were adduced to support such a conclusion.

Turning to mammals exclusive of man, we may note first a paper by Dr. Guy E. Pilgrim,[26] of the Geological Survey of India, in which are described a number of new or little-known anthropoids from the Miocene and Pliocene of India. The author discusses the affinities of the higher primates and the ancestry of man in the light of the new evidence and regards the extinct genus *Sivapithecus* as very near to the direct ancestry of man. *Pithecanthropus* he considers to be approximately intermediate, while the Piltdown man (*Eoanthropus*) and Neanderthal man (*Homo neanderthalensis*) are relegated to a side branch derived from an earlier stage in the ancestral series than *Sivapithecus.* Pilgrim's conclusions in regard to other extinct and existing genera are no less unexpected. Among the living anthropoids the gibbon is considered nearest to the hominid stem. One species of the Miocene *Dryopithecus* is believed to be related to the gorilla, and the new genus *Palæosimia* to the orang. Pilgrim's views are criticized by W. K. Gregory.[27]

The well-known anthropologist Professor Gustav Schwalbe[28] of Strassburg contributes an extended description of *Oreopithecus* and a conservative discussion of the affinities of this ape of the European Miocene.

Dr. W. K. Gregory[29] summarizes his studies on the lemuroid Primates and discusses the evolution and relationships of the lemuroids of the Eocene of North America and Europe. A significant feature in this author's classification is the association of all the living and extinct lemurs of Madagascar, in spite of their diversity of form and size, in a single group, more primitive than the African and Oriental lemuroids, and nearly related to the Eocene *Adapis* and *Notharctus* of Europe and North America. The African bush-baby (*Galago*) and East Indian loris (*Nycticebus*) are more progressive types, the tarsier (*Tarsius*), although still grouped with the Lemuroidea, in many respects approaches the higher primates. The group of small Eocene primates known as Anaptomorphidæ are now included under the Tarsiidæ; *Necrolemur* of the French Oligocene is related to *Tarsius* and *Galago,* but, with *Microchœrus,* is held in a distinct family.

The conclusions just enumerated, based upon anatomical grounds, have a most important bearing upon the evolutionary history and dispersal of the primates. That Madagascar has served as a refuge for primitive survivals of a group once widespread is not surprising. That the diversity of the Malagasy primates covers an underlying near affinity points to their derivation from a single stock, not from the remnants of a diverse lemuroid fauna of the adjoining continents.

Dr. W. D. Matthew and Mr. Walter Granger[30] describe a series of new or little known primates and primate-like Insectivora from the North American Eocene and trace the history of these groups through the successive horizons of the Eocene. In the best known group of these Eocene lemuroids, the

[26] *Records Geol. Surv. India,* Vol. 45, pp. 1–74; 4 pls. and 2 figs.

[27] Science, Vol. 43, pp. 341–342.

[28] *Zeitsch. f. Morph. Anthr.,* Vol. 19, pp. 149–254.

[29] *Bull. Geol. Soc. Amer.,* December, 1915.

[30] *Bull. Amer. Mus. Nat. Hist.,* Vol. 33, Part I., Carnivora, W. D. M.; Parts II. and III., Condylarthra, W. D. M. and W. G.; Part IV., Primates, etc., W. D. M.

Notharctidæ, the evolution of the teeth is traced through a series of minute gradations from the base of the true Eocene to its upper levels. A restudy of the famous "*Anaptomorphus*" skull, with newly discovered referred material shows that it is a distinct genus from the lower jaw upon which this genus was originally founded; the dentition of several other genera of this group is described chiefly on new material, and all are referred to the same family as the modern tarsier. Two other groups, imperfectly known and of doubtful affinities, the Microsyopidæ and Apatemyidæ, are retained in the Insectivora, but their primate resemblances pointed out.

The above-mentioned papers add largely to the data for reconstructing the evolutionary history of the order primates, including man, a line of investigation that is being actively followed. The latest results of researches upon the "Piltdown Man" (*Eoanthropus*) are summarized in the British Museum Guide to the Fossil Remains of Man.

An interesting announcement by Matthew and Granger in the paper above cited is of the discovery of a relative (*Arctostylops*) of the peculiar Notoungulates of South America in the North American Eocene. These extinct hoofed animals were abundant in the Tertiary of South America, but were supposed to be wholly limited to that continent. Although this announcement rests solely upon the evidence of a lower jaw, the pattern of the premolar and molar teeth is so characteristically like the Notoungulate type and so unlike any other that it is regarded as reasonably certain.

Other sections of the same revision cover the Condylarthra (*Phenacodus, Ectocion, Meniscotherium, Hyopsodus,* etc.) and the primitive Carnivora or Creodonta. The true distinctive characters of the genera and species of these groups, based upon far larger collections than had been previously known, are described, several new genera and many new species described, and the exact geologic horizon and range of each species is specified. The affinities of each species to those of earlier and later horizons are discussed, and the materials and evidence brought together for a faunal and phylogenetic final chapter when the revision has been completed.

The skeleton of *Myotragus,* a remarkable type of antelope discovered in the Pleistocene caves of the Balearic Islands by Miss Dorothea Bate is described by Dr. C. W. Andrews[31] of the British Museum of Natural History. It is allied to the rupicarpine antelopes, but distinguished by a single pair of much-enlarged rodent-like incisor teeth. From the later Tertiaries of California Professor J. C. Merriam,[32] of the University of California, describes various new three-toed horses and other mammals, and Dr. O. P. Hay,[33] of the U. S. National Museum, describes a skull of the rare and peculiar Sirenian *Desmostylus.* Dr. Hay has also published several valuable contributions on American Pleistocene mammals, especially of Iowa.[34] From the Pliocene of Nebraska, Professor E. H. Barbour,[35] of the University of Nebraska, has secured a number of new proboscidean skeletons and skulls, adding largely to our knowledge of this interesting group. Mr. H. J. Cook,[36] of Agate, Nebraska, and Dr. W. J. Sinclair,[37] of Princeton University, also describe a number of new Pliocene mammals from Nebraska, including a remarkable antelope with scimitar-shaped horns. From the basal Eocene of Montana Mr. J. W. Gidley,[38] of the U. S. National Museum, describes a lower jaw referred to the Myrmecobiidæ or banded anteaters of Australia.

[31] *Phil. Trans. Roy. Soc. London,* Vol. 206, *B,* pp. 281–305, 4 pls.

[32] "New Protohippine Horses" and other titles in *Bulletins* of Dept. Geology, Univ. California; *Popular Science Monthly,* March, 1915, pp. 245–264.

[33] *Proc. U. S. Nat. Mus.,* Vol. 49, pp. 381–397, 3 pls.

[34] Ann. Report Iowa Geol. Surv., Vol. 23, pp. 1–506, 75 pls. *Proc. U. S. Nat. Mus.,* Vol. 48, pp. 515–575, 7 pls.

[35] *State Journal,* Lincoln, Neb., January 3, 1915.

[36] Four articles in *Rep. Nebraska Geol. Survey,* Volumes 4 and 7.

[37] *Proc. Amer. Phil. Soc.,* Vol. 54, pp. 73–95.

[38] *Proc. U. S. Nat. Mus.,* Vol. 48, pp. 395–402, pl. XXIII.

[In the reviewer's opinion this jaw agrees in most of its characteristic features with the Leptictidæ, a family of Insectivora, and the single feature of resemblance to *Myrmecobius,* the relative height of inner and outer trigonid cusps is by no means sufficient evidence for relationship to the marsupials. The tooth considered by Mr. Gidley to be the first molar appears to the reviewer to be clearly a fourth premolar, as it is set deeper in the jaw and less worn than the tooth behind it, belongs therefore to the successional series or premolars, not to the first series of cheek teeth (milk and true molars), and is characteristically like the fourth premolar of all the Leptictid genera, especially that of an undescribed genus from the Paleocene (Torrejon formation). The skull and skeleton characters of *Myrmecobius* are, on the other hand, in near agreement throughout with the polyprotodont marsupials, and wholly at variance with Gidley's conclusion of an independent parallel evolution of the group from pre-Tertiary ancestors. W. D. M.]

An important monograph by Professor H. Winge,[39] of Copenhagen, upon the Edentata of the Pleistocene of Brazil includes an authoritative systematic revision of the order, and critical notes of great interest.

Dr. O. Abel, of Vienna, has published a small but richly illustrated book entitled "Die vorzeitlichen Säugetiere." American fossil mammals are exceptionally well represented.

Under the title of "Climate and Evolution" Dr. W. D. Matthew,[40] of the American Museum of Natural History, presents a theory accounting for the observed geographical distribution of animals in present and past ages. He begins by applying to the facts certain modern geological doctrines, such as the correlated alternations of elevation and of climate during geological time, the isostatic balance of continental and ocean masses, and the persistence of the great continental masses which never sank to abyssal depths, but often permitted the sea to make temporary incursions upon their surfaces. Partly by means of a remarkable series of maps, showing the present and past distribution of many races of mammals, the author adduces very weighty evidence for the view that these races originated in the northern continents and then spread southward into South America, Africa, southeastern Asia and Australia.

Professor H. F. Osborn,[41] of the American Museum of Natural History, contributes to the American Naturalist an extended study of certain features of the process of evolution. Basing his conclusions on a wide range of zoological, experimental and paleontological data, he develops the distinction between "rectigradations," or qualitatively and numerically new characters and "allometrons," or changes in proportion, degree or intensity.

The same author[42] summarizes the successive advances and retreats of the continental glaciers and the corresponding shiftings of the floras, faunas and human populations. The special feature of this paper is the demonstration that in Europe, as in America, the so-called "warm fauna" survives until the advance of the fourth glaciation. The last topic is more fully treated in Professor Osborn's recently published work entitled "Men of the Old Stone Age." Here the author gives a detailed description and analysis of the long series of Paleolithic stages in Europe, with a series of new restorations of *Pithecanthropus,* of *Eoanthropus* and of the Races of Neanderthal and Crô-Magnon.

C. R. Eastman,
W. K. Gregory,
W. D. Matthew

39 "Aftryk af 'E Museo Lundii' Köbenhaven," 1915.

40 *Annals N. Y. Acad. Sci.,* Vol. 24, 1915.

41 *American Naturalist,* Vol. 49, April, 1915, pp. 193–239.

42 "Revision of the Pleistocene of Europe, Asia and Northern Africa," *Annals N. Y. Acad. Sci.,* July, 1915.

## SPECIAL ARTICLES

### A PHOMA DISEASE OF WESTERN WHEAT-GRASS

Western wheat-grass, *Agropyron smithii* Rydb. is a very important forage plant in many of the pastures in the Salt Lake Valley,

and any disease which would tend to limit its growth might be considered as being of economic importance. During the past season the writer has collected at a number of points within the Salt Lake Valley specimens of this grass on which there was found a *Phoma* which seems not to have been heretofore recorded as occurring on it.

The species of *Phoma* under consideration does not seem to agree with any of the species described as occurring on various species of Gramineæ. A review of the literature indicates that a considerable number of species of *Phoma* have been found on the Gramineæ but many of them are imperfectly described, so that it is difficult to tell whether the species of *Phoma* occurring on Western wheat-grass is or is not new. In some respects it resembles *Phoma lophio stomoides* Sacc., although the spores are smaller, being as a rule less than 15 $\mu$ in length; rarely spores of 15 $\mu$ or over are found. Owing to the size of the spores and other prominent characters it is possible that the species is new. A more extended note will be published later.

P. J. O'GARA

SALT LAKE CITY, UTAH,
September 23, 1915

## A FUNGUS OF UNCERTAIN SYSTEMATIC POSITION OCCURRING ON WHEAT AND RYE

FOR some time the writer has been studying a very interesting organism which has been found occurring on wheat and rye. Specimens of wheat and rye infected with the organism have been collected at various points in the Salt Lake Valley. The fungus seems to attack the heads of both wheat and rye some time before they emerge from the sheaths. Very often the heads are so severely attacked as not to emerge but remain permanently within the sheath. The fungus is usually found on the rachis, the glumes, the essential organs and the inner parts of the sheaths. At no time has it been found to occur on the internodes below the upper node. The effect upon the inflorescence seems to be such as to prevent the normal development of the essential organs.

The organism was readily isolated and has been grown in pure culture for several months. It grows readily in agar, potato, rice and other media producing normal mycelium and fruiting bodies. The mycelium is white or hyaline, multi-septate and much branched, varying from about 2.5 to 5.8 $\mu$ in thickness. Perithecia-like bodies are borne on either short or long stalks on the mycelium or they may be borne terminally. Generally they are found singly but often are more or less grouped. These bodies are from 9 to 17.5 $\mu$ in diameter, being spherical or slightly oval, brown to dark brown in color and containing small refractive bodies 2.5 to 5.8 $\mu$ in diameter held in a more or less granular mass. The number of refractive bodies may vary from 1 to 6, there being no seeming regularity in number. The walls of the perithecia-like bodies are $\frac{1}{2}$ $\mu$ or less in thickness and can be readily separated from the contents, leaving the contents virtually intact.

In some respects this fungus bears a striking resemblance to *Endomyces mali* Lewis.[1] However, no sporidia are produced and the perithecia-like bodies do not contain germinating ascospores. It is therefore only the general appearance of the fungus in culture that bears a resemblance to the perithecia-bearing mycelium of *Endomyces mali*. The perithecia-like bodies of this apparently new organism are produced singly or on short branches of the mycelium or terminally without the fusion of cells or nuclei. When the perithecia-like bodies are placed in culture media germination follows within a very short time, producing a vigorous mycelium which in turn produces perithecia-like bodies in about 5 to 7 days, depending upon temperature conditions.

It has not been determined as yet what may be the function of the refractive bodies generally found in the perithecia-like structure. It is possible that these bodies may be storage material inasmuch as they have not been seen to germinate. Undoubtedly a considerable amount of cytological work must be done in order to determine the systematic position of the fungus. This work is in progress and at

[1] Bulletin No. 178, Maine Agricultural Experiment Station, April, 1910.

a later date a more extended account of the fungus will be given. P. J. O'Gara

Salt Lake City, Utah,
September 23, 1915

## THE MEETING OF SECTION C AT THE COLUMBUS MEETING OF THE AMERICAN ASSOCIATION

The first session was held on the afternoon of Friday, December 31, in Chemistry Hall, Ohio State University, Vice-president William McPherson in the chair, with an attendance of about 70, practically all from the immediate vicinity of Columbus. The following officers were elected:

*Vice-president and Chairman of the Section*—Julius Stieglitz, Chicago.

*Member of Council*—W. Lloyd Evans, Columbus.

*Member of General Committee*—M. T. Bogert, New York.

*Member of Sectional Committee*—A. A. Noyes, Boston.

The following papers were read:

"Some Interesting Physical and Chemical Properties of Clays" (illustrated by experiments), by Arthur S. Watts.

"The Contributions of Chemistry to the Production and Preparation of Human Food," by John F. Lyman.

"The American Chemist and the War's Problems," by James R. Withrow.

At six o'clock the members present enjoyed a very pleasant dinner in the Ohio Union. This was followed at 8 o'clock by a session, attended by about 200, at which Dr. Frank K. Cameron gave an address entitled "The Fertilizer Resources of the United States."

John Johnston,
*Secretary of Section C*

## THE MATHEMATICAL ASSOCIATION OF AMERICA

On December 30 and 31, 1915, there was held at Columbus, Ohio, the organization meeting of a new mathematical association, the call for which had been signed by 450 persons representing every state in the Union, the District of Columbia, and Canada. The object of the new association is to assist in promoting the interests of mathematics in America, especially in the collegiate field. It is not intended to be a rival of any existing organization, but rather to supplement the secondary associations on the one hand, and the American Mathematical Society on the other; the former being well organized and effective in their field, and the latter having definitely limited itself to the field of scientific research. In the field of collegiate mathematics, however, there has been, up to this time, no organization and no medium of communication among the teachers, except the *American Mathematical Monthly*, which for the past three years has been devoted to this cause. The new organization, which has been named the Mathematical Association of America, has taken over the *Monthly* as its official journal.

There were 104 persons present at the organzation meeting. The constitution and by-laws together with a full report of the proceedings will be published in the January issue of the *Monthly*. The following officers were elected:

*President*, Professor E. R. Hedrick, University of Missouri.

*First Vice-president*, Professor E. V. Huntington, Harvard University.

*Second Vice-president*, Professor G. A. Miller, University of Illinois.

*Secretary-Treasurer*, Professor W. D. Cairns, Oberlin College.

*Publication Committee*, Professor H. E. Slaught, University of Chicago, managing editor, Professor W. H. Bussey, University of Minnesota, and Professor R. D. Carmichael, University of Illinois.

These officers, together with the following, constitute the executive council:

Professor R. C. Archibald, Brown University; Professor Florian Cajori, Colorado College; Professor B. F. Finkel, Drury College; Professor D. N. Lehmer, University of California; Professor E. H. Moore, University of Chicago; Professor R. E. Moritz, University of Washington; Professor M. B. Porter, University of Texas; Professor K. D. Swartzel, Ohio State University; Professor J. N. Van der Vries, University of Kansas; Professor Oswald Veblen, Princeton University; Professor J. W. Young, Dartmouth College; Professor Alexander Ziwet, University of Wisconsin.